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ABSTRACT

A SERIES OF PAPERS AND DELIBERATIONS OF THE CONFERENCE ARE PRESENTED WHICH--(1) IDENTIFY THE POLICIES, PRACTICES, AND PROCEDURES OF THE VARIOUS AGENCIES, (2) IDENTIFY AND DISCUSS UNRESOLVED PROBLEMS RELATED TO VALUE ENGINEERING, AND (3) DERIVE CONCLUSIONS REGARDING THE FUTURE COURSE OF VALUE ENGINEERING PROGRAMS IN FEDERAL CONSTRUCTION AGENCIES. BOTH THE DESIGN AND CONSTRUCTION PHASES OF VALUE ENGINEERING ARE DISCUSSED IN RELATION TO THEIR INFLUENCE ON NEW CONSTRUCTION PROJECTS. SEVERAL FEDERAL CONSTRUCTION AGENCIES REPORT ON THE RELATIONSHIP OF VALUE ENGINEERING TO THEIR AGENCY. SPECIFIC PROBLEM AREAS IN VALUE ENGINEERING ARE ANALYZED SUCH AS--(1) PRINCIPLES OF ORGANIZATIONAL ARRANGEMENTS, (2) COST REDUCTION, (3) THE POSITION OF VALUE ENGINEERING IN MANAGEMENT, (4) CONTRACT INCENTIVE CLAUSES, (5) PROJECT SELECTION AND INITIATION, (6) CONFIGURATION MANAGEMENT, (7) TECHNIQUES AND PROCEDURES, AND (8) INNOVATIONS AND MANAGEMENT SUPPORT. (TC)

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BUILDING RESEARCH ADVISORY BOARD

Federal Construction Council

Symposium-Workshop Report Number 4

VALUE ENGINEERING IN FEDERAL CONSTRUCTION AGENCIES

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VALUE ENGINEERING
IN
FEDERAL CONSTRUCTION AGENCIES

Symposium/Workshop Report No. 4

The report of a conference convened by the
FEDERAL CONSTRUCTION COUNCIL, BUILDING RESEARCH ADVISORY BOARD
at the
NATIONAL ACADEMY OF SCIENCES
Washington, D. C.
May 27, 1969

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The Federal Construction Council serves as a planning, coordinating, and operating body to encourage continuing cooperation among Federal agencies in advancing the science and technology of building as related to Federal construction activities.

In this pursuit, its specific objectives include: Assembly and correlation of available knowledge and experience from each of the agencies; elimination of undesirable duplication in investigative effort on common problems; free discussion among scientific and technical personnel, both within and outside the Government, on selected building problems; objective resolution of technical problems of particular concern to the Federal construction agencies; and appropriate distribution of resulting information.

The Council as such comprises eleven members appointed by the BRAB Chairman from among BRAB membership, plus one member from the senior professional staff of each of the supporting Federal agencies (currently ten), also appointed by the BRAB Chairman on nomination from the individual agencies; all appointments are subject to approval by the President of the National Academy of Sciences.

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VALUE ENGINEERING PANEL

While the Federal Construction Council itself has overall responsibility for its technical programs, specific projects such as this conference are carried out under the direction of appointed task groups or panels of engineers, architects, and scientists, each possessing qualification in some phase of the subject under consideration.

Each task group or panel member serves as a specialist in his field or as a generalist in the problem area, not as a spokesman for or representative of his own agency or any other organization with which he may be associated.

At the request of the Council, the following persons were designated by the various agencies to serve on the Value Engineering Panel. As panel members, they organized the conference, prepared papers, and served as discussion leaders.

GEORGE B. BEGG (Conference Moderator), Public Buildings Service, General Services Administration

WILLIAM S. ALLDREDGE, Office of the Chief of Engineers, Department of the Army

FORREST ANDREWS, Public Buildings Service, General Services Administration

HAROLD G. ARTHUR, Bureau of Reclamation, Department of the Interior

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FOREWORD

Value engineering is a controversial subject in the Federal construction agencies. Opinions differ strongly, among agencies and within agencies, as to the worth of value engineering and how value engineering should be performed. In essence, the question is: What type of value engineering, if any, is best for the Federal construction agencies? In the hope of finding some acceptable answers to this question, the Federal Construction Council convened a Conference on Value Engineering in Federal Construction Agencies at the National Academy of Sciences on May 27, 1969.

This is a report of the deliberations of the conference, together with a compilation of papers prepared for the conference. Although edited slightly for consistency and general conformance to Academy style, the papers are published essentially as submitted by the authors.

On recommendation of the Federal Construction Council, the Building Research Advisory Board has approved this report for publication.

Although no definitive solutions are offered in the report, it is believed that the report will serve as a useful statement of current practices in value engineering and present thinking on the subject.

The Board gratefully acknowledges the work of the Value Engineering Panel in organizing the conference, in the preparation of papers, and in discussion leadership. The assistance of all others who contributed to the effort is sincerely appreciated.

JOHN P. GNAEDINGER, Chairman
Building Research Advisory Board

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I
INTRODUCTION

Objectives

The objectives of the Conference on Value Engineering in Federal Construction Agencies were:

1. To identify the policies, practices, and procedures of various Federal construction agencies regarding value engineering programs; to determine the experiences of agencies in implementing and administering such programs; to determine the views of the various agencies as to the effectiveness of such programs
2. To identify and discuss unresolved problems which affect the future of value engineering
3. To derive conclusions regarding the future course of value engineering programs in Federal construction agencies

The objective of this report is to present an orderly account of the conference and thus provide a broad overview of value engineering in Federal construction agencies.

Scope

The conference covered value engineering during both design and construction.

Definition

For the purpose of the conference (and this report), value engineering was defined by the moderator as follows:

> Value engineering is an engineering and architectural discipline that (1) focuses attention on the essential function in a chosen design or construction objective, and (2) emphasizes meeting the essential function at the lowest total cost.

During the deliberations, it was urged by some that the second part of the definition be expanded to include, in addition to cost reduction, such values as immediate design improvement, improved specifications and guidelines for later construction, evaluation of new systems and materials, and encouragement to designers to be innovative.

Organization of the Conference

The conference, which was open to officials and professional employees of all Federal agencies involved in construction activities, lasted one day and was attended by some 80 persons. The conference format was as follows:

1. Prior to the conference, seven Federal construction agencies having value engineering programs prepared papers on their programs, along the lines of the first conference objective. Authors of the papers were members of the Value Engineering Panel. The papers were printed and distributed to conference participants as background information--and not orally delivered. Also, prior to the conference, the Value Engineering Panel met to decide upon details of the conference program.

2. At the conference, the moderator outlined the conference objectives, and Henry A. Borger summarized the current state of value engineering programs in Federal construction agencies, pointing out similarities and differences. Following a question-and-answer period on the agencies' programs, each panel member presented a formal paper on a previously identified problem area in value engineering. The panelists and conference attendees were then led by the moderator in a discussion of, first, problems related to value engineering and, second, the probable future of value engineering. Finally, the moderator summarized the conclusions and discussion of the conference.

Organization of the Report

This report is divided into five main sections:

I. Introduction

II. Conclusions and Observations
(A concise presentation of the conference deliberations, with due consideration given to the formal papers)

III. Keynote
(Opening statement of conference objectives, made by the moderator)

IV. Value Engineering Programs in Federal Construction Agencies
(Papers prepared and printed prior to the conference as background information, followed by an analytical summation)

V Analysis of Specific Problem Areas in Value Engineering
(Formal papers on previously identified areas presented at the conference)

There are two appendixes to the report; the first is the conference agenda, and the second contains reference material on value engineering.

II
CONCLUSIONS AND OBSERVATIONS

The Conference on Value Engineering in Federal Construction Agencies was planned and organized in advance and adhered to its agenda, but the deliberations, despite the presentation of formal papers, were characterized by spontaneity. This section is an organized presentation of the conclusions and observations of the conference, with due consideration to the views expressed in the formal papers.

Basic Concepts of Value Engineering Programs

The value engineering programs of Federal construction agencies can be categorized in two ways: (1) as to their degree of formality; (2) as to whether they provide for value engineering during both the design and construction phases or during just one phase.

Formal, Informal, and Semiformal VE Programs

In a formal value engineering program, a number of professional engineers are assigned full-time or part-time specifically to value engineering work. The duties of such engineers include:

Promoting the use of value engineering throughout the agency

Identifying matters suitable for investigation by means of value engineering techniques

Directing value engineering studies

Expediting the implementation of study recommendations

Evaluating value engineering change proposals submitted by contractors (if the agency permits contractors to submit such proposals)

Preparing the paperwork required to obtain due credit for savings realized through value engineering

In informal value engineering programs, no one is assigned specifically to value engineering work. Instead, a large number of design engineers are taught value engineering techniques and, under the direction of engineering management, such techniques are used, when appropriate, on day-to-day engineering problems. In this approach, design engineers, subject to review by management, are responsible for evaluating value engineering proposals submitted by contractors.

In semiformal value engineering programs, the design engineering staff is basically responsible for value engineering work, with, however, top management direction of the overall value engineering effort provided by a management-staff coordinating office.

VE-in-Design Programs and VE-in-Construction Programs

Value engineering during design means that value engineering techniques are employed by or in conjunction with the design engineering staff to investigate matters relating to a project, usually before it is advertised for bid. Value engineering during construction means that contractors are encouraged to propose changes to a project and, if the changes are accepted, to share in the savings that result.

Nine Possible Types of VE Programs

Combining the various possibilities in the two categories, there are nine possible types of value engineering programs:

1. Formal--during design only
2. Formal--during construction only
3. Formal--during design and construction
4. Informal--during design only
5. Informal--during construction only
6. Informal--during design and construction
7. Semiformal--during design only
8. Semiformal--during construction only
9. Semiformal--during design and construction

Two agencies that participated in the conference have Type 3 programs, two have Type 6 programs, and one has a Type 7 program.

Each agency is generally satisfied that the type of program which it has selected is the one best suited to its particular needs.* And the consensus was that no one type of program is best for all agencies.

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*Two of the agencies did, however, indicate that they were considering changing to a different type of program in the future.

Problems in Implementing Programs

Getting Top Management Support

Top management support is essential regardless of the type of program employed.

In all programs top management support is needed initially for the training of engineers in value engineering principles and techniques. In programs in which funds are budgeted annually for value engineering studies or for value engineering staff, continued top management support is needed. As a rule, such continued support can be ensured only if savings can be demonstrated--for example, by tying the value engineering program to a cost reduction program in which claimed savings are validated in accordance with established accounting rules.

In agencies in which value engineering programs have been tied in with cost reduction programs for validation of savings, the paperwork has frequently proved to be a considerable burden to those responsible for administering the value engineering program. Moreover, in such circumstances there is sometimes a temptation to "play the numbers game" (i.e., to direct effort toward making a good showing on paper even though the result might not be best in the long run). At other times, value engineering administrators are frustrated and disheartened because accounting rules deny credit for worthwhile accomplishments.

Without disputing the need for and desirability of employing some mechanism for measuring the effectiveness of value engineering programs, it would appear that effort might well be directed toward improving the mechanisms now employed.

Getting Middle Management Support

Informal and semiformal value engineering programs succeed only if middle management (i.e., the various levels of engineering administration responsible for design) understands and believes in value engineering techniques, because in such programs middle management is directly responsible for initiating and carrying out value engineering studies and implementing resulting recommendations. Obtaining the support of middle management requires basically that many of the managers involved be fully trained in when and how to use value engineering techniques and be convinced that such techniques can be a powerful tool when used properly.

The same holds true for formal programs; however, with formal programs, the problem of getting middle management support is complicated by the resentment or suspicion that managers sometimes feel toward the value engineer, coupled with the view that his efforts are an unwarranted intrusion into the design bailiwick. Such resentment and suspicion can, however, be eliminated or greatly minimized if value engineers understand the problem and develop rapport with the design managers, but this takes effort. (Less effort is ordinarily required if the value engineer has a design background and proven technical ability.)

Selecting Subjects for Value Engineering Study During the Design Phase

A value engineering study can be expensive and time consuming; hence, regardless of the type of program involved, it is important to exercise care in selecting the subject to be studied. There are two primary considerations in this regard: (1) potential savings, (2) timeliness.

With regard to potential savings, it is highly desirable to screen carefully the various subjects proposed for study in order to identify the ones that offer the greatest potential savings. Although this would appear self-evident, the fact is that the screening process has on occasion not been carried out properly, and the limited manpower resources available for value engineering studies have been applied to the wrong problem.

With regard to timeliness, there are two considerations:

1. The process of identifying potential subjects for study should be undertaken at the proper time during the design process. The proper time depends on the project; in some, the proper time is at the start of design, before an overall concept has been decided upon; in others, the proper time is after major decisions have been made (here the value engineering effort would deal primarily with details); in still other projects, the process should be carried out twice--at the beginning and again later, after major decisions have been made.

2. Value engineering studies of selected subjects should be undertaken soon enough to permit results to be used. It has unfortunately happened in the past that studies were undertaken so late that, by the time they were completed, the design was too near completion to permit incorporation of study recommendations. (They could, however, be considered in future projects.)

Getting Value Engineering Studies Performed Properly

Assuming that the subject of a value engineering study has been well selected and is timely, the worth of the study depends upon how well it is performed. Associated with the performance of value engineering studies are three problems not fully solved:

1. Accurate Cost Information

The first is the matter of obtaining accurate cost information on which to base comparisons of alternatives. Various methods have been tried to get such information--including having professional estimators serve on value engineering study teams, and retaining contractors or private consultants to provide estimates--but none has proved fully successful, mainly because of the many incalculable factors involved in estimating.

2. Proper Mix of Personnel

   The second is the matter of determining the proper mix of people to assign to value engineering teams to ensure that due consideration is given to all relevant factors. Improvement has been made in this area over the years; however, more frequent inclusion of operating and maintenance personnel on teams might prove beneficial.

3. Training in VE Techniques

   The third is the matter of the training of team members in value engineering techniques. The techniques are not particularly difficult to learn, but formal training is usually required; without such training, a team member is likely to be unable to participate properly in a value engineering study. Most agencies with value engineering programs of any type have trained a considerable number of their engineers in the techniques, but continuation of the training effort is needed to indoctrinate new agency employees. (Many value engineers are of the firm opinion that training in value engineering techniques greatly helps design engineers in their day-to-day work.)

Getting Study Recommendations Accepted

Agencies, especially those with formal programs, have suffered the experience of having study recommendations rejected out of hand or simply ignored by engineering managers. Presumably, this problem would be greatly minimized if the various problems previously mentioned were solved.

Improving VE-in-Construction Programs

Value-engineering-in-construction programs have suffered in the past from a number of somewhat overlapping problems:

1. Many contractors have declined to participate at all (i.e., they have submitted no change proposals).

2. Many contractors who have participated have tended to submit large numbers of ill-conceived proposals.

3. The amount of time spent by agency personnel (value engineers in the case of formal programs) processing proposals has been inordinately great in relation to the savings realized.

4. Engineering managers have frequently shown a disinclination to approve proposed changes.

The first three problems are in the process of being solved through the education of contractors in the value-engineering-in-construction program. The fourth problem is related to problems mentioned in preceding sections and will be solved when these are solved.

The Future of Value Engineering Programs

Whether value engineering programs expand or die depends on how well the various problems which have been identified are solved. In the process of solving problems, it is possible that some agencies might change to different types of programs--most likely away from strictly formal and informal programs toward semiformal programs.

If the use of value engineering increases (and this appears probable), the construction programs of all agencies would benefit greatly if some mechanism could be found for interchanging broadly applicable ideas that are developed through value engineering studies.

III
KEYNOTE

George B. Begg*

You have been invited to this conference to participate in a searching look at the merit, performance, and potential of value engineering in Federal design and construction programs. I shall briefly outline the sequence of events that brought you here, comment on our agenda, and then propose a give-and-take climate that should fully involve you in this meeting.

The desire for this conference originated in the Federal Construction Council. After the Council developed the objectives, scope, and procedures for the meeting, many of the Federal building agencies were asked to submit papers outlining their current value engineering programs and their plans for the future. After some editing, the agencies' papers have been printed and distributed to your agency.

Finally, the agenda** for the conference was worked out in a series of meetings with appropriate representatives from several of the agencies. The agenda is intended to provide rapid insights into the three key considerations of (1) agency practices, (2) current problem areas, and (3) the future of value engineering.

Agenda Item No. 3 will provide a distillation of agency practices, and considerable comment is expected during Item No. 4 if you conclude that we have misstated your value engineering program.

Probably our speakers' formal presentations (Item No. 6 in the agenda) are the most important part of the prepared program, because these are their reading of the "gut" issues that are keeping value engineering from exerting greater influence on the building programs of the agencies. If you analyze the subjects to be presented by our speakers, you will note their conclusion that careful attention should be given to the ways in which value engineering relates to other disciplines contributing to design and construction programs. In other words, we are emphasizing procedures and processing, rather than specific how-to-do-it techniques. To be very frank, this emphasis is based on the belief that the lack of greater support in some agencies does not arise from disagreements about value engineering techniques, but rather from the question of how to mesh the objectives and conclusions of this relatively new discipline with the functions of more established offices.

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*As conference moderator, Mr. Begg gave a brief keynote address, setting forth the scope of the conference.

**Appendix A of this report contains the conference agenda.

Having heard our speakers, you may not agree with the significance and priorities they claim for their subject. If so, this is an open forum where you are encouraged to outline your experience and viewpoint. In turn, we plan to stay flexible. If other problem areas appear more important than those presented, we will gladly shift to the new problems.

Agenda Items No. 9 and No. 10 deal with the future of value engineering in the Federal agencies. We believe that our remarks will be most pertinent if they grow spontaneously from the insights gained from your comments in the earlier parts of the conference. During Item No. 10, we will ask you to step aside briefly from the official position of your agency and give this audience your independent thoughts on how value engineering should develop in the coming years.

A few words are desirable about two assumptions made in planning this meeting. The first assumption was that all those attending the conference have at least an elementary knowledge of the principles and objectives of value engineering. Paradoxically, the second assumption was that it is next to impossible to get a consensus on the definition of value engineering and unless care were taken we could spend half the conference arguing about the definition. With this is mind, I am going to use my position as moderator to define value engineering for this session:

> Value engineering is hereby defined as an engineering and architectural discipline that (1) focuses attention on the essential function in a chosen design or construction objective, and (2) emphasizes meeting the essential function at the lowest total cost.

In conclusion, it is emphasized that all the agencies face the problem of providing up-to-date construction at the lowest total cost. Its advocates say that value engineering is one way of meeting this updating and cost concern, and as such it deserves serious attention. Its critics say that good engineers practice value engineering as part of their profession. We welcome all such differences of opinion; we need more than a day-long talk-fest. From our viewpoint, the success of the conference depends on your caring enough to become actively involved in the discussions on staffing, procedures, techniques, feedback, and payoffs. You are now free from your telephones and in-baskets, and we would like you to participate fully in making this a significant conference with payoff conclusions and recommendations on the proper role of value engineering in the agencies' construction programs.

IV

VALUE ENGINEERING PROGRAMS IN FEDERAL CONSTRUCTION AGENCIES

This section contains papers prepared prior to the conference by seven Federal agencies having value engineering programs.

The papers were prepared in partial fulfillment of the first conference objective, namely:

> To identify the policies, practices, and procedures of various Federal construction agencies regarding value engineering programs; to determine the experiences of agencies in implementing and administering such programs; to determine the views of the various agencies as to the effectiveness of such programs.

Authors of the papers were members of the Value Engineering Panel. The papers were printed and distributed to conference participants as background information--and not orally delivered.

At the conference, Henry A. Borger presented an analytical summation of the current state of value engineering programs in Federal construction agencies. The summation is contained in this section, following the papers prepared by the Federal agencies.

VALUE ENGINEERING IN THE CORPS OF ENGINEERS

William S. Alldredge

History The Corps of Engineers began its Value Engineering (VE) program in 1964 by taking two significant steps. In October of that year, the first of a series of VE workshops was conducted by a private consulting firm for Corps employees who, for the first time, discovered what VE can do. In the same month the first Corps project containing a VE incentive clause was advertised for bids. Progress in the program was understandably slow during the first two or three years. A VE regulation was issued, but field offices were left to their own devices for developing their individual programs.

Early in 1966 the first full-time VE positions were created in the Office, Chief of Engineers, followed by a series of efforts, aimed at unifying the program and increasing its effectiveness and productivity. A crash training program resulted in VE indoctrination of over 4,000 persons in a period of less than five months. Subsequent tightening of regulations made it mandatory that active programs (both in-house and by contractors) utilizing standard VE principles and methods of application be established and maintained. Field offices were urged to create full-time VE positions, and were required to establish these positions at staff level where the VE officer could have easy access to all organizational elements. Nationwide promotion of contractor participation was initiated, and an operational guide for VE officers was written and distributed. Promotional efforts, such as printing and distribution of posters, circulars containing VE items of interest, etc., were made. A construction-oriented workshop was initiated in 1968 for the benefit of field offices in need of additional and more comprehensive training. Twelve of these workshops have been held to date. All of this effort has resulted in increased savings to the Government. The Corps is justifiably proud of its growing VE program.

Policy The stated policy of the Chief of Engineers is: "VE will be actively applied in Civil Works and military-funded activities, and in the performance of work for others."

Regulations The Chief of Engineers has set forth guidelines in regulatory form for the VE program which establish policy, responsibilities, objectives, organization, funding, progress reporting, and coordination of the overall VE effort for the Corps of Engineers. In addition, the Chief of Engineers publishes engineering circulars and publications to disseminate information of general interest concerning the VE program. In like manner, lower echelons of the Corps issue instructions.

Organization The Corps field organization consists of Division offices at the first level below the Office, Chief of Engineers (OCE), and District offices at the second level. At present there are 13 Division offices and 42 District offices. Division and District organizational structure throughout the Corps follows a basic standard. However, not all

Divisions and Districts of the Corps have both Civil Works and military-funded activities.

The chain of command for operating the Corps VE program is from OCE through the Division Office to the District offices. Below the District offices there are numerous Area Engineer and Resident Engineer offices established to conform with project workloads. Instructions from OCE to the field and reports from the Field to OCE on accomplishments follow this chain. Division offices are the intermediate points between OCE and the Districts; they manage the District VE program and report directly to OCE.

The Corps of Engineers follows the concept that the VE management function should be placed at an organizational level which is independent of functional interest and which will permit the balanced application of available resources. In the Office, Chief of Engineers, the Comptroller is responsible to the Chief of Engineers for the VE program. Instructions to the field direct that Value Engineering Officers (VEO's) be designated Special Assistants on the staff of Division and District Engineers at a level above the technical elements. The Corps has 55 VEO positions in the Division and District offices, 34 of which are full-time, and 4 in OCE, 3 of which are full-time.

Procedures In conformance with the Corps concept of maximum decentralization of authority, with the placement of design and construction at the District level, only broad guidance is given the Districts in establishing procedures for organizing and operating their VE programs. However, in all Districts the District Engineer is responsible for the VE program as well as all other activities of his District. He looks to his special assistant, the VEO, for execution of this VE responsibility. Placing the VEO at staff level not only allows direct and ready access to all operating levels within the District, but also emphasizes top management support of the program.

Procedures for operating a VE program in a District are usually tailored to fit the functions performed by the District. The procedures are, to a considerable extent, controlled by the organizational structure of the District. Some Districts have a VE Program Board which assists in the implementation and operation of the program, and a VE Project Selection Committee which, with the VEO, selects projects for study. Others have only a VE Board or Committee which is brought into action at the request of the VEO. Some Districts have no permanent boards or committees established to assist in the administration of the VE program.

VE actions that have resulted in savings fall into the following two general types: 1) In-house VE studies performed by Corps personnel during either the design or construction phase, and 2) Value Engineering Change Proposals (VECPs) submitted by construction contractors under the VE incentive clause of their contracts. In-house studies on projects selected by the VEO, or others, are generally performed by teams appointed for this purpose, but may be informal studies by one or more individuals on projects they have selected for study. VECPs submitted by contractors are discussed in the next paragraph.

Contractor Participation In the beginning of the VE program, when a VE incentive clause was first included in construction contracts, contractors were unfamiliar with VE procedures and reluctant to participate. Because of the contractors' slowness in taking advantage of the increased profits available to them through VE, the Corps actively promoted contractor participation.

VE is discussed at all pre-construction conferences, and resident engineers are requested to promote the program throughout the life of the contracts. A VE booklet was published especially for contractors. Many Corps employees have spoken on the subject of VE at meetings of the Associated General Contractors of America. Briefings, schools, and seminars have been offered to contractor personnel, many of whom have taken advantage of them. Hundreds of letters on VE have been sent to successful Corps bidders.

The following escalating incentive arrangement, instituted in June 1968, was the result of seeking better participation: Of the realized savings, the contractor receives fifty percent (50%) for the first two approved proposals, fifty-five percent (55%) for the next two approved proposals, and sixty percent (60%) for all other approved proposals on any one contract. Contractors are encouraged by Corps personnel to discuss informally possible VECPs with the Contracting Officer or his authorized representative to minimize the risk of rejection. These and other efforts have done much to greatly increase contractor participation, particularly in the last two years, as indicated by the table below.

CONTRACTOR PARTICIPATION UNDER INCENTIVE CLAUSE

Number of VECP's by Fiscal Year

	FY 65		66		67		68		69(1st½)		Total	
	MC	CW	MC	CW	MC	CW	MC	CW	MC	CW	MC	CW
Submitted:	63	29	94	79	111	110	184	123	206	84	658	425
Approved:	32	16	49	31	68	72	122	61	119	54	390	234

NOTE: MC indicates Military Construction Projects
CW indicates Civil Works Construction Projects

Results Results of the VE effort by the Corps of Engineers are expressed as savings in the tables below.

TOTAL VE SAVINGS, ALL ACTIONS
($Millions)

FY	MILITARY	CIVIL	TOTAL
65	$ 2.3	No report	$ 2.3
66	5.3	$ 6.0	11.3
67	8.4	7.0	15.4
68	11.4	10.7	22.1
69(1st half)	2.6	1.4	4.0
TOTALS	$ 30.0	$25.1	$55.1

VE SAVINGS FROM VECP'S

FY	MILITARY	CIVIL	TOTAL
65	$ 116,700	$ 140,600	$ 257,300
66	107,600	199,000	306,600
67	259,600	402,100	661,700
68	505,700	526,600	1,032,300
69(1st half)	279,700	393,600	673,300
TOTALS	$1,269,300	$1,661,900	$2,931,200

Implementing the Program The Corps has experienced numerous difficulties in implementing its established VE policies and procedures. Early in 1964 VE was not considered applicable to construction, but the experience of others in this field reversed Corps thinking, and the program was initiated. Because of the vast lack of knowledge of the principles and application of VE, there was wide-spread opinion that the procedure was no different from standard practices of good engineers down through the ages. This created an obstacle to the advancement of the program. In addition, many engineers resented this "meddling" in the affairs of reputable designers. Continuing education is rapidly overcoming these adverse reactions, and "selling" VE is a much simpler job now than it was three or four years ago.

Little by little, the Corps VE program is developing from a haphazard (and at times, half-hearted) effort by a handful of part-time "value engineers" into a progressive, productive organization capable of effecting maximum cost reduction.

Program Effectiveness There can be no doubt as to the effectiveness of the Corps VE program when considering the fact that there was no program as late as October 1964, and that in less than four years VE was saving the Corps more than $22 million a year. There must be a "leveling off" period at some time; but at present the results of the program improve continuously, both in-house and in contractor participation. Effectiveness is proven. It is now simply a matter of advancing toward maximum effectiveness.

VALUE ENGINEERING IN THE BUREAU OF RECLAMATION

Harold G. Arthur

From the beginning of Federal Reclamations, some sixty-seven years ago, economy in our activities has been an essential way of life with us. The vigorous pursuit of economy has been traditional in our agency, first, because our engineers are professionals who take pride in doing a job as economically as possible; and, second, and more importantly, because of special Federal funding arrangements for Reclamation projects. These arrangements require that Congressionally appropriated money for Reclamation activities be eventually returned to the U.S. Treasury by project beneficiaries in the form of revenues collected from them. In this regard, about 90 percent of the Bureau's investment in water resources project construction is later repaid by the beneficiaries (repayments to date total nearly one billion dollars, as against Reclamation expenditures estimated at between five and five and one-half billion dollars). Therefore, in order to make water available at an acceptable price to as many people as possible, it is mandatory that project costs be held down.

Demands for water continue to mount while labor, materials and other costs increase. The most economical water development projects have already been built. These factors make it increasingly difficult to economically justify new projects. We are thus compelled to make even greater efforts in lowering costs wherever possible.

Therefore, in Value Engineering (VE), we see an extension of this continuing Reclamation engineering mission. The sophistication of the VE approach and the refined techniques of its analysis have, of course, added a new dimension to our endeavors. We have benefited from professional VE advisors who have brought to our engineers the fundamentals of its procedures, and who have increased our understanding as to how they may be successfully utilized.

Our experience in VE spans more than four years. Initially, a small select group of engineers participated in briefings sponsored by the Department of the Interior held here in Washington, D.C., early in 1965. The briefings were presented by a management consultant firm. Following these introductory sessions, we arranged in the summer of 1965 for the firm to present a series of 16-hour orientation lectures to some 200 members of our Denver engineering staff. These orientation lectures attained the limited objective of acquainting our top staff members and most of our middle management staff representatives with the techniques of VE.

These initial orientation sessions led us to the conclusion that VE had definite possibilities of providing the vehicle by which we could objectively review our design practices to the end that we could produce better and more economical designs. Subsequently, we arranged for a group of 38 professional staff members in Denver, representing a variety of engineering disciplines, to undertake intensive training under the same management firm. This training was in the form of a 40-hour workshop. The trainees were later chosen to be members of several study teams which would appraise assigned problems and recommend new approaches for improving design methods and lowering costs.

Both our executive engineers and those in middle management positions expressed general approval of the application of VE fundamentals to their engineering work. Virtually all of the middle managers agreed that this new approach would be useful in stimulating creative thinking and in solving old problems.

In the four years since its introduction in Reclamation, VE has grown in importance as a flexible tool in both design and construction. Brainstorming and the searching-appraisal techniques of VE have been particularly highlighted in our design work. As a matter of fact, the very first VE study undertaken by a team of four engineers has paid the richest dividends. This study was concerned with analysis of design practices pertaining to penstock intakes of powerplants. The team's VE analysis indicated that the penstock intakes and appurtenances at our Flaming Gorge Dam in Utah could have been constructed for $586,000 less than their actual cost.

On the basis of this study, the VE team concluded that the bellmouth entrances to the twelve 40-foot-diameter penstock intakes at Grand Coulee's Third Powerplant could be successfully modified without significant hydraulic losses. The saving in materials and construction costs at this huge power installation, now under construction at Grand Coulee Dam, will make possible the extraordinary savings of $13,000,000.

The results of another early VE team's brainstorming have also been fruitful. This study, which embraced the deflections of vertical shafts in earth dams, was prompted by the knowledge that previous practice avoided placing the shafts in the embankments, even though alternative designs were considerably more costly. This practice resulted from difficulties encountered at two dams caused by deflections of the shafts in the embankments which, in turn, caused cracking of the concrete and misalignment of elevator equipment and piping. The team's search inquiry into this design practice led to the conclusion that the problems caused by deflections of shafts in embankments were not as serious as had been originally thought, and that the difficulties of misalignment could largely be overcome by increasing slightly the inside diameters of the shafts and by making provisions for adjustments of elevators and gate guide metalwork. As a direct result of this VE study, the specifications for the outlet works of an earthfill dam under design at that time were revised. Through this revision reduction achieved in dam construction costs exceeded $100,000.

In addition to these accomplishments, other teams have explored and reported their findings on: 1) the relative merits and costs of 600-volt and 5,000-volt insulated electrical wires and cables; 2) evaluation of the types of electrical transmission tower footings for various foundation conditions; 3) differential settlement under outlet works conduits; and 4) methods of controlling and sealing contraction cracks in concrete canal lining.

The intensive inquiries and critiques on these widely disparate endeavors are indicative of the versatility of our VE teams. They also underline the diversity of problems confronting Reclamation engineers in advancing resource development goals.

Seven other VE teams are now moving forward to expand our knowledge and to give us fresh insight into a variety of engineering activities. These efforts are concerned with protection of discharge chutes and stilling basins for spillways, and also outlet works, from damage arising from hydrostatic uplift forces; evaluation of indoor versus outdoor pumping plants and powerplants; pressure tunnels, and use of penstock and pipes in "walk-in" tunnels in lieu of pressure tunnels; evaluation of pumped storage projects; foundation grouting; protection of stilling basin surfaces from damage; and nameplates for piping and other hydraulic equipment.

Again, these on-going VE studies of design practices reflect the great diversity of Reclamation engineering. We expect that the teams' analyses will open new avenues for us and will give our Chief Engineer and other key managers new options in evaluating future engineering projects. The study of pumped-storage projects can be cited as an example of the importance of such evaluations and their impact on our future water resources developments in the western states.

It should be added that some of these on-going VE studies, and others we will undertake in the future, may not result in significant reductions in costs of the structures we design. For these studies, however, we believe that, from a managerial standpoint, there is a definite, although intangible, benefit to be gained as a result of the searching-appraisal techniques of VE.

As important as VE is to our design efforts, we expect that contractors engaged in Reclamation construction will contribute even greater savings. This belief is fostered by our long experience with the ingenuity and resourcefulness of the contracting industry and by our firm conviction that contractors have the continuing facility to find new and more economical ways to carry forward their work. As you may know, virtually all Bureau of Reclamation construction is carried out by private contractors. In the last fiscal year, for example, contractors were entrusted with 99.7 percent of our construction. The drive, skills, and initiative of these contractors have done much to assure the success of Reclamation development during the past six decades.

In VE we see a continuing opportunity to offer incentives to contractors so that they can sustain their progress in developing new techniques which will lower our project construction costs. In this regard, we have offered for the past three years a VE incentive option in all Bureau construction contracts exceeding $200,000. This encourages contractors to submit cost-savings suggestions. The VE contract provision offers the contractor the opportunity to share the resultant savings with the Government on a 50-50 basis.

In this way, we are challenging construction contractors to develop new ways of streamlining their activities, and to suggest improved methods of reducing costs on our West-wide construction. Any progress thus made will be mutually advantageous to Reclamation and to the contracting fraternity. The Associated General Contractors of America, through its Reclamation Task Unit, has recognized the importance of this incentive to contractors.

In practice, we recommend that contractors follow a simple two-step procedure in submitting a VE proposal to us. First, we suggest that a contractor engaged in an on-going Bureau construction contract inform the contracting officer of his cost-reduction proposal in accordance with the provision of the specifications. Second, the proposal itself should include a description of the difference between the existing drawings or specifications requirements and the modifications proposed by the contractor, an itemized estimate of the reduction in the contractor's costs, any pertinent information the contractor considers necessary, and a statement concerning the time within which the contractor must have a decision thereon by the Bureau.

We, in turn, promptly review the contractor's proposal and endeavor to accept or reject the proposal in writing within the time limit set by the contractor. If the proposal is accepted, we notify the contractor by telegram or letter so that he will be able to proceed promptly with the proposed change while the formal order for changes is being processed.

The VE proposals we have received thus far from contractors total tens of thousands of dollars in construction savings. For example, in the construction of our Pleasant Valley Pumping Plant, Discharge Line, and Switchyard in California, the contractor recommended to our Project Construction Engineer that nine motor-operator exciter field rheostats be substituted for the originally specified generator-type of rheostats for the pumping plant. The contractor pointed out that not only would there be a substantial reduction in price, but there would also be a considerable reduction in delivery time, which he considered important in maintaining his construction schedule. We reviewed this VE proposal and accepted it. As a result, the original contract cost was reduced by $10,000. Under the VE contract provision, the contractor received $5,000 for his recommendation.

The contractor's initiative in the construction of a section of our high-voltage Fort Thompson-Grand Island Transmission Line in South Dakota and Nebraska led to a $12,000 reduction in construction costs. His recommendations concerned changing certain steel tower transmission line footings.

Another contractor's VE proposal involved construction of a reach of the San Luis Canal in California, which resulted in a $16,000 savings. He proposed that a polyvinyl chloride waterstop, lighter in weight than the type of waterstop originally specified, be used in the contraction grooves of the canal's concrete linings. His initiative was rewarded by payment to him of half of the savings, or $8,000.

Other VE proposals received from contractors and approved by us cover a variety of recommended changes in procedures and materials, including those for bridge construction and for canal and electrical work.

We are gratified by the savings realized through practical and productive contractor proposals. However, we are hopeful that a larger number of contractors on our construction projects will help us in our continuing efforts to reduce construction costs, and will take greater advantage of the VE incentive provisions in our contracts. Considering the great scope and diversity of our construction throughout the 17 Western States, the opportunities for the contractors to share in beneficial savings are virtually unlimited.

One possible area of study is in the concept of today's construction practice of sequential operations. That is, once the construction of a facility has started, it is important to the overall economy that construction be continuous until substantially completed. Perhaps the best illustration of this type of operation is the modern method of lining canals. Any suggestions by contractors that would lead to studies that will develop this type of operation in other areas would be most welcome.

Our Chief Engineer in Denver has repeatedly challenged the notion that old ways of doing work must be accepted without questioning their current adequacy. "To hell with grandpa!" he has pithily stated. Accordingly, the Chief Engineer, as the Bureau's principal contracting officer, offers to contractors the opportunity to explore new frontiers through VE proposals. He has asked that Reclamation project construction engineers alert contractors to the incentive provisions of their contracts. This is done by discussions with contractors during preconstruction conferences or as soon as practicable during the early stages of the contracts.

The impact of savings in construction on future Reclamation developments is immeasurable. Such savings in the Bureau's day-to-day construction are significant and influence our yearly programs. Of far greater significance, however, is the importance of economical construction in terms of its overall influence on Reclamation water resources development. The savings in construction that have been mentioned represent only a small fraction of their worth in relation to the actual value of the total Reclamation program. When we consider such factors as the value of crops grown on lands irrigated by Reclamation projects, the phenomenal municipal and industrial growth made possible by Reclamation water supplies, and the tax returns from Reclamation project areas, it is obvious that Bureau of Reclamation developments create wealth many times over the Federal investment in the program. In this vital overall view of Reclamation's worth, therefore, the savings achieved through VE techniques, both by the Bureau's engineers and by the private construction contractors, are compounded manyfold and in many indirect ways.

That is why we shall continue to utilize the expertise of Value Engineering in reducing costs of future design and construction programs. Hopefully, contractors will work closely with us for our mutual advantage and for the lasting benefit of generations to come.

VALUE ENGINEERING IN THE NAVAL FACILITIES ENGINEERING COMMAND

Laurence Schuman

Introduction Value Engineering (VE) has been a part of the Naval Construction Program for approximately eleven years. It has evolved from the small beginning made by the Engineering Specifications and Estimates Branch of the Engineering Division, Naval Facilities Engineering Command* (NAVFACENGCOM) into the present principal cost-saving device in the construction field.

In 1958 a billet was assigned the task of following up on New Materials and Construction Methods, with the objective of improving construction and reducing costs through utilization of greater selection of materials and reducing restrictive details. Studies were made on several projects, and savings were realized, by group participation, in the development of improved specifications and designs. The experience gained in the early years enabled the Command to contribute valuable ideas to the Steering Committee in establishing the original Navy VE Program, which now contributes a significant input to the overall Cost Reduction Program.

Policy NAVFAC (Naval Facilities) Policy recognizes and supports existing VE Programs and fosters the initiation of additional VE Programs wherever the potential savings are deemed to be of significant size. Operations must cover Navy (in-house) and contractor oriented projects in which VE techniques must be fully utilized.

VE is treated as an intensified appraisal of all the elements of selected projects. It covers design, procurement, materials, construction, operation, and maintenance. Studies and recommendations are made to achieve the highest possible performance, maintainability, and reliability of the item at minimum cost.

Program The Program provides an analysis of NAVFAC systems equipment, installation, and supplies coming into use or already in use, and of the processes which affect the technical characteristics of the various parts required to support the needed function. The VE cost reduction results determine the merit of the Program and give it visibility.

VE is encouraged at all levels within the Command, and at all stages of project development. Early design studies are preferred since these offer the greatest potential for savings.

Staff Until September 1963, there were two full-time value engineers assigned to cover the VE and New Materials Programs. When the Department of the Navy VE Program was inaugurated, NAVFAC directed each of its Engineering Field Divisions to establish a VE Point of Contact, and instructed these to implement the VE Program and to report the results of such work. This resulted in a build-up of VE personnel to thirty-six part-time men in addition to the original two full-time men.

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* Formerly Bureau of Yards and Docks

By the end of FY 1965, three of the collateral duty billets had been converted to full-time billets because of the savings potential in their areas. The augmentation program, which was started at this time, provided for five additional full-time positions. Three others were added by the Field Divisions, making a total of thirteen full-time and twenty-five collateral duty billets. Recently, one more full-time billet has been added while three have reverted to collateral duty leaving eleven full-time and twenty-eight collateral duty billets now functioning. Each value engineer is alone in his Field Office, but may call on the Field Division Design and Specification Engineering Force for assistance in his studies.

Training NAVFAC value engineers are professionals with varied academic and experience records; their principal fields being Civil, Mechanical or Electrical Engineering, Architecture and/or Construction and Costing training. Contacts among field value engineers, as well as contacts between the field and Headquarters staff, are encouraged. Thus, a collective effort is brought to bear on many distinct specialized areas of design and construction. Each value engineer is encouraged to take the PAVE Training Course and to attend other educational programs that can improve his VE work. Conferences and workshops are planned as often as possible. VE Bulletins and Newsletters as well as New Materials Bulletins are used to keep field personnel up to date on the program.

Procedures The NAVFAC VE Program proceeds according to three major devices promulgated by the Department of the Navy under directives from DOD.

Perspective and methodology concerning the practice of VE are based on the DOD Value Engineering Handbook 5010.8H, 12 September 1968. Responsibility for incentive participation by contractors follows the provisions of ASPR Part I, Section 17, "Value Engineering." The Cost Reduction and Management Improvement Program Manual NAVSO P-2486 provides procedures for reporting savings, establishing goals, and recognizing outstanding performances. NAVFAC guidance and instruction amplifies the details of these three devices and directs their adaptation to the construction program.

To implement the programs, Staff responsibilities for all VE billets within the Headquarters and field units are established by the Assistant Commander for Engineering and Design.

Since VE is a management technique, and since fixed regulations and standards tend to stifle the freedom of thought necessary in the VE process, NAVFAC allows each of its value engineers maximum leeway in balancing his program insofar as training, technical studies, and office details are concerned. Because personalities and background training vary widely, considerable variation in practices is found in the field offices.

The principal variations are:

1. The value engineer is primarily concerned with training and promotion. The engineering staff, being cognizant of VE principles, searches for ideas from its design and review actions and reports these to the value engineer for further action.

2. The value engineer is an integral part of the in-house and A&E design reviews. He locates potential savings with design assistance (either formally or informally), and conducts a VE value engineer study resulting in realized savings.

3. The value engineer is brought into a project design to reduce the cost without changing the scope or quality level so that the project can be put out for bid within the funds available.

4. In all Field Divisions, the value engineer is responsible for maintaining an educational program that will acquaint contractors in the intricacies of the Contractor's Incentive Program, and assists the Officer in Charge of Construction in reviewing Contractor's Change Proposals when offered by the Contractor.

5. The value engineer is also responsible for the original preparation of any VE cost saving report to be entered into the Cost Reduction Program, and for the necessary follow-up work in achieving validation of the savings through the Naval Audit Service.

Accomplishments The accomplishments of the program are measured by the dollar volume of savings achieved in the Cost Reduction Program. The following table shows these figures from the program's start:

FY	Valid Savings	Goal
1964	8,064,000	700,000
1965	8,032,000	6,000,000
1966	12,093,000	8,000,000
1967	6,726,000	4,000,000
1968	10,491,000	5,000,000

Goals and reportable savings were reduced for FY 67 and future years due to the elimination of "cost avoidance" savings credited to the Cost Reduction Program. In addition to the savings tabulated above, NAVFAC reported $16,400,000 in savings credited to other DOD components. The total valid savings to this date are nearly $62,000,000 for the five year period (estimated at roughly $775,000 per VE man year). During this period the Command has recorded a total of 210 VECP's for a total government share of $635,200.

Problems The major problems of VE in the NAVFAC Program lie in the areas of implementation and reporting.

Efforts to develop cost conciousness in the main body of design and specifications engineers are now beginning to take effect, and the original contention that value engineers were opponents of the regular professionals is rapidly diminishing.

The relatively large amount of clerical work required for VE reporting cuts deeply into the productive effort of the value engineer. In this regard, it should be noted that the review and reporting of VECP's received from Contractors requires an effort much larger than the monetary savings should support. Simplification of this system should be undertaken to encourage Government personnel as well as the Contractor.

Difficulties are experienced in retention of trained VE personnel. These engineers are a special type, having broad experience, training and a questing mind. They are in high demand by other groups within the Command and by other Agencies outside the Command. Grade incentive and an increase in the number of value engineers could help this situation. The effectiveness of the Program would increase in proportion to support given such an expansion.

And finally, there is the popular misconception that VE will result in poor quality products because of its emphasis on function and cost saving. Case histories prove otherwise in the vast majority of individual actions. Only education, observation and open-minded evaluation can rid us of this obstacle.

VALUE ENGINEERING IN THE VETERANS ADMINISTRATION

Sidney J. Helene

The Veterans Administration had considered the desirability of establishing a Value Engineering (VE) program for some time. Two approaches to VE were possible: 1) its application in the design phase--as a review technique, that is, during preparation of working drawings or 2) its application in the construction--that is, by the contractor.

After weighing the advantages and disadvantages inherent in both approaches, the Veterans Administration decided to experiment with VE in design stage, principally because all savings realized at this stage would accrue to the Government, and, in addition, design function would remain entirely in the hands of the designers. In the construction phase, savings would have to be shared with the contractor.

When VA decided to embark on a VE program--an activity in which it had no practical experience--a consultant specializing in that field was retained to introduce the techniques of the art. A VE seminar for demonstration and training purposes followed in which a group of experienced building design specialists participated.

Essentially, the seminar aimed at analyzing requirements, and the facilities designed to satisfy these requirements in light of cost effectiveness. Training was directed toward areas of construction where probable cost savings could be made without loss of function, longevity, appearance, maintainability, or dependability. The seminar was attended by 19 architects, engineers (including two engineers from other agencies), and hospital specialists. The model for the VE training program was a $19,000,000 hospital project, working drawings and specifications of which were at the 100% stage of completion. The training was accomplished in a 40-hour seminar comprising 10 half-day periods.

Seminar discussions involved such matters as: Factors entering into comparison cost estimating, selection of alternative construction systems, and problems involved in implementation of cost reduction suggestions. Also conducted were demonstrations of "creative thinking" and methods of formal presentation of VE findings, with supporting evidence, figures, sketches, and cost comparisons.

While the training program was intended to "train" and teach the techniques of VE, it was hoped that, as a secondary end result, practical cost saving suggestions would be generated for actual use on the very project used as a model, since bidding on this project had been temporarily suspended.

The results of this effort proved surprisingly successful. Although only a few days were expended in examination of the project used as a model, total potential savings in three of the four items selected for study were calculated at $287,000. Further examination of the technical and cost characteristics of the items showed that these savings could practically be realized with no disadvantage functionally. Most of the cost-conscious substitutions developed from this one effort have been incorporated into subsequent ongoing projects, with multiplied cost savings. An additional intangible dividend was the sharpened awareness of all involved personnel to the opportunities of controlling wasteful practices in construction and design.

As a result of the VE training, the following recommendations were offered at the conclusion of the program:

1. Participation by personnel knowledgeable in their individual fields is a prime necessity.

2. Allocation of sufficient time to study projects, obtain prices and performance data, and to make recommendations, are required.

3. A VE program, in order to be successful in overcoming the hurdle of inertia, requires positioning for organizational stature and full management backing.

Conclusions arrived at were:

1. The larger projects are the most amenable to VE because of the relatively large savings that could accrue from cost reduction on a single item.

2. The areas of greatest cost (systems and construction items of a repetitive nature) offer the greatest opportunity for savings on the project under VE consideration and on future projects.

3. Personnel engaged in VE should be free to cross organizational lines in the performance of their duties, and should be responsible only to top management for VE activities.

4. Recognition of personnel (for VE cost savings suggestions) by top management should provide a spur to VE efforts and probably promote continued enthusiasm for the program.

5. Personnel responsible for implementing cost saving substitutions should be instructed by top management to consider inclusion in projects all applicable VE recommendations.

In order to achieve maximum effectiveness, it is necessary that the value engineer make himself aware of design conditions and constraints, and that he understands what the architect/engineer is attempting to achieve and what the impediments in his path are. This would require that he have access to records, correspondence, and cost estimates. His experience should enable him also to challenge office standards for practicability, timeliness, etc.

Our limited experience, gleaned from the VE demonstration, indicates that the value engineer should make his analysis after design has progressed to the point where all systems are well defined. Sufficient time, however, should be planned into the program to permit examination of VE recommendations, review and comments by the designers, administrative acceptance or rejection of recommendations, and the revision of plans and specifications, if indicated. Experience suggests that changes rushed through at the last moment, or provided as a change order after contract has been let, will usually be unprofitable from a cost saving point of view.

Our experience with a very limited portion of one project seems to indicate that VE may be a program well worth pursuing. Further activity by our office, however, is presently awaiting an administrative determination regarding organization, personnel assignments and direction. As in all new programs previously untried, many factors remain to be discussed. We anticipate that some of the questions worth considering will be:

1. Cooperation of A/E or in-house designers with the VE program. Shall the A/E be informed of the VE program at the time of entering into a contract with the Government? A formal procedure should probably be developed for presentation of VE suggestions to the A/E. The procedure should allow time for consideration by the A/E and the necessary alterations to contract documents. For projects designed in-house, an impersonal procedure should be developed for conveying VE suggestions to the in-house design staff so as to avoid the appearance (to the designers) of adverse criticism. The in-house VE program should be set up as a team effort, with both designers and value engineers receiving credit for the cost effectiveness of the completed design.

2. Implementation of accepted recommendations. After incorporation of accepted VE recommendations into the contract documents, the recommendations should be further implemented by amending or revising construction standards, "master" or "guide" specifications, and standard details where applicable, so that the savings can be repeated on other projects.

VALUE ENGINEERING IN THE POST OFFICE DEPARTMENT

Riley A. Murray

Introduction The Post Office Department Value Engineering (VE) program is relatively new and differs in several respects from the organizational concept usually promoted for VE. Not all VE programs have been successful, the usual excuse being that management would not support the VE effort. The fact is that in many instances management would not force the organization to fit a stereotype plan of VE operation.

Background for POD VE Program To be responsive to organizational requirements, a VE program needs to be recognized for the function it serves in resources management. Traditionally, organizations are established to solve problems or to develop items or services which are desired or needed and which can be exchanged for a profit. In industry, profit takes the form of money. In government, profit takes the form of benefits for the people.

To obtain these profits or benefits normally requires the expenditure of resources. While resources have always had a constraining influence on industry actions, many have considered government resources to be unlimited. Today we realize that both industry and government have limited resources, and recognize that both have the organizational constraints or accomplishment with minimum expenditure of resources.

The function or purpose of VE is to achieve equal or better solutions, items, or services, with a reduction in total expenditure of resources (i.e., manpower, time, facilities, and money). The need for VE developed as organizations became larger and management responsibilities had to be delegated. With this division in responsibility came the transfer of authority for items or services as these progressed from concept to end use.

The problem that has to be contended with is the impossibility of a complete transfer of knowledge when responsibility and authority are transferred. VE is both a management tool and a discipline aimed at providing continuity in the transfer of knowledge across management lines of authority, and for providing a feedback of new information and knowledge for better utilization of resources.

VE can only be justified to management when there is a resultant savings from the resources expended to accomplish the VE.

VE in the POD This would be a simple presentation if we could merely outline a POD policy for VE, present the method of POD VE operation, and then give an appraisal and outlook for the future of VE in POD. But, all we can do is outline the basic concepts that were established in starting VE in POD and point out the changes that are taking place.

From the beginning, it was determined that the POD VE program should be established on an operational foundation, rather than on a VE superstructure at upper management level. The POD VE program does have upper management support. What we have tried to avoid is creating upper management pressure on the line organization (already overloaded with work) by making VE a line function.

VE programs, in general, have been based on a centralized VE operation, with upper management tied in by a VE management advisory committee. There are two main disadvantages with the centralized VE program:

1. Upper management involvement in details is necessary.

2. Considerable friction is developed between the line organizations and the centralized VE group because of upper management pressure on the line organization.

The POD VE program has been planned with a different organizational approach. The organizational differences are:

1. A decentralized VE operational performance by line organization personnel assigned specifically to perform VE studies.

2. Direct functional staff reporting and coordination of the overall VE program.

The Post Office Department VE program recognizes that all organizations are different and are subject to change. The Post Office Department has changed greatly, and indications are it will change even more in the future. The VE plan of operation is being tailored to fit a dynamic Post Office Department and, therefore, must be dynamic itself, rather than static.

It is difficult for many to recognize that organizations have personalities that can be as different as people. VE is, to a large degree, an exercise in human relations. To expect all organizations to respond to a textbook VE plan of operations is naive. This is especially true when VE preaches concepts at variance with accepted management principles.

One area of conflict involves responsibility, authority, credit, and blame. Giving the VE organization responsibility and credit for reaching VE goals while authority and blame for accomplishment rests elsewhere, is difficult to reconcile.

Under the POD VE plan of operation upper management support (money and manpower) is required for the line organization. However, the line organizations are responsible for the actual performance of VE. The reason is simple. The responsibility and credit for VE achievements must rest with the level of organizations having primary authority to approve VE changes--namely; the line organizations.

The VE Staff in POD is responsible for coordinating the program, for providing guidance and direction, and for controlling and reporting VE accomplishments to POD management. VE as a management tool provides for transfer of information and knowledge, but it is a wasted resource unless the information and knowledge transferred is gainfully employed. Until implementation is accomplished, a VE proposal is only a good idea. Assuming that tentative or even final approval of a VE proposal ends the responsibility of VE, is a mistake.

The important step of routinely verifying that the change has been implemented is often neglected. In many instances, savings have been lost because the approved change was "pigeon-holed."

A tentative approval begins a transfer of knowledge cycle which is equally as important as the cycle which generated the proposal. The fact that the value engineer is working on another VE proposal and loses contact with the previous one cannot be accepted as a valid excuse. A VE proposal that is stopped short of implementation represents a waste of the resources spent in developing the proposal.

The VE staff does not have the authority to approve or implement a VE change. However, they do have the responsibility for apprizing management groups having that authority that a loss in management resources will occur if the change is not implemented.

The original method for management control of VE proposals was to provide a monthly status report to responsible POD management. This method had some degree of success. However, as the number of VE proposals increased, an undue amount of management review and evaluation was imposed in determining whether management action was necessary. The present method of advising upper management is to select a limited number of VE proposals which will represent a substantial loss of resource savings unless management action is taken. A monthly follow-up by the VE staff on all proposals is maintained on the proposals until implemented or closed out.

The general concept for the POD VE program was initiated in Construction Engineering on a limited basis in February 1968. The present POD VE position is outlined in Addendum "A". Four major changes make it different from our original VE position paper:

1. Cost goals were initially planned that followed classical VE concepts, but dropped to eliminate fictitious savings being reported.

2. POD Form 4126 was developed to record the initiation of VE studies, thus eliminating any doubt in the auditing of VE accomplishments.

3. In addition to the responsibility and credit for VE accomplishments belonging to the line organization, VE is to be done by value engineers in the line organization and not by value engineers for the line organization. This means the line organizations are to be given the time and money for manpower specifically assigned to do VE.

4. The responsibility for VE originally ended with the implementation approval of the VE proposal. Now, the VE staff reports the status of the VE change until it has been implemented. The lack of urgency associated with VE changes often resulted in their being "pigeon-holed" for more important things, and then forgotten.

Our VE Program is just getting underway in a Post Office Department that has embarked on a major modernization program. We expect changes will have to be made in our VE Program in order to keep pace. We believe this is as it should be since we feel the VE technique is subject to improvement, just as anything else is subject to improvement by means of the VE technique.

Conclusions Even though manpower limitations prevented full-time assignment of line-organization personnel to VE, and the direct functional reporting has been basically limited to Construction Engineering management, it is possible to draw certain conclusions and outline the future direction we aim to pursue.

1. There has been a minimum of friction between the line organizations and the VE staff (some friction is inevitable between the VE staff and those middle management men who view VE as an attempt to discredit them).

2. VE provides a cross-check on specifications and functional requirements, and provides recommendations for resource savings.

3. VE line organization achievements have been limited by the lack of personnel and lack of aggressive pursuit of VE proposals.

4. VE proposals are generated in many areas outside the responsible area, and multiple coordinations are often necessary for approval and implementation.

5. A communication gap or delayed response exists among the VE stages of change initiation, approval, and implementation.

6. VE is a staff function for resources management. VE has the responsibility for apprizing responsible line management of opportunities for resource savings; but line management alone has the authority and responsibility for implementation action.

Future POD VE Plans

1. Expand the VE program by assigning personnel to the line organization to perform VE studies. Specifically, line VE personnel should be assigned to the Assistant Directors, with the results reported to the Office of the Director.

2. Assign VE staff personnel to upper management levels to consolidate and coordinate the individual Bureau VE efforts.

3. Report VE accomplishments through the line organization to the Postmaster General's Planning Staff for overall management control and allocation of resources to perform VE.

4. Implement a VE incentive clause in POD contracts to obtain the benefits from contractor VE efforts.

5. Insure that VE change proposals are properly executed. VE proposals rejected, or inactive for extensive periods of time, should be systematically reviewed by the highest level VE staff.

6. The VE staff should maintain a status report on all VE proposals and be responsible for apprizing management when resource savings are in jeopardy.

An additional recommendation which would be helpful to VE, and which would benefit the POD in general, would be the adoption of Configuration Management. Configuration Management is, basically, a system of management control using baselines which identify, control, and audit the transfer of knowledge and the requirements for an item or service as they move through the stages of development and use.

ADDENDUM A

Value Engineering Position Paper

Value Engineering (VE) for the Post Office Department (POD) is defined as an organized effort directed at analyzing the function of POD equipment, facilities, and components for the purpose of achieving the required (needed and wanted) functions with maximum cost effectiveness.

To develop the potential of VE involves four basic steps:

1. Establishing the need for using VE within the line organization.

2. Establishing VE goals, policy, operating procedures, and functional relationship with the line organization.

3. Establishing work projects.

    (a) Contractor

    (b) In-house

4. Implementing VE proposals.

Step 1

Establishing the Need for VE

It is essential that a VE program be established and implemented into the line organization by directive for a number of reasons:

1. VE is a staff function without authority for decision.

2. VE changes require acceptance and approval by line organization decisions.

3. Implementation of VE changes can only be accomplished by line organization decision.

Depending on the line organization to make use of VE services by merely making a VE staff available is a permissive approach that has not been acceptable in the past.

The positive approach is to establish responsibility for VE cost saving or cost avoidance in the line organization. This approach stresses the fact that costs are a line organization responsibility. The motivation for accomplishment of VE by the line organization will be the report of achievement through the VE staff coordination group to upper management.

The use of cost saving goals will be avoided to prevent the creation of fictitious savings.

Before cost goals are established, specific ground rules for measurement of accomplishment will be required to insure the results are in fact "real."

Step 2

Value Engineering Goals, Policy and Operating Procedures

Goals

The VE Program goal will be to optimize the performance, reliability, maintainability, and other required characteristics of Postal System equipment facilities and components while minimizing total overall costs of the item, processes and procedures being designed, developed, manufactured, constructed, or utilized.

Primary Objectives

The VE Staff will recommend Post Office Department policies and procedures for integrating and applying VE during design and conception, production design, procurement, production, construction and service.

Primary Responsibilities

The VE Staff will be responsible for the efficient performance of the VE function in accordance with established policies and procedures.

a. The responsibilities of the VE Staff will encompass development, planning and operational methods, and procedures for obtaining maximum VE accomplishment.

Organizational Policy

The VE Staff functions as the office of primary interest in the policy making and operational performance of matters related to VE for cost effectiveness in postal operation. The VE organization will be responsible for the preparation and presentation by management of reports on the line organization improvements in cost effectiveness. The prerogatives of acceptance and approval of VE recommendations rests with the line organization. There is, and will be, no change in the established lines of authority in consideration of VE recommendations.

In recognition of the fact that differences of opinion will occur as to the acceptability of a VE recommendation, the following procedure will be observed by the value engineer:

The value engineer will make every effort to resolve any VE proposal at the lowest authoritive decision making level. If the value engineer is convinced of the merit of a VE proposal and cannot resolve it at the lower decision level, he may pursue it to the next higher level provided he declares his intention to do so and has the lower decision level personnel in attendance when presenting his case to the next higher level of authority.

In no case will the value engineer carry his case to any higher decision level. Instead, he shall refer his proposal to the Chief of Value Engineering for further consideration.

The VE activity will be organized into two functional areas: Operation and Coordination, as indicated in the functional organizational chart, Figure 1. The VE functional relationship with the line organization is shown in Figure 2.

The functional organization charts for the VE activity are not intended to indicate VE personnel, but the functional performance divisions.

The VE Operations Group will be concerned with the actual performance of VE. The prime responsibilities of this group are to assist the line organization in generating VE change proposals and in performing VE studies on assignment from activities responsible for the item to be studied.

The VE Coordination Group, regardless of where it is located in the organization, will monitor and record overall VE program accomplishment by the line organization along the functional lines shown in Figure 2. The coordination group will develop operational procedures and program control measures to support the line organization value engineers and will provide management with the documentation necessary to evaluate the VE Program effectiveness. Typical of the responsibilities assigned will be to:

1. Approve orientation and training programs to insure comprehension and motivation for the application of VE in all applicable activities.

2. Develop sources and procedures for the initiation and submittal of VE projects.

3. Recommend VE projects for study which will be of greatest cost effective benefit to the POD.

4. Develop policy and procedures to be followed in the performance of VE studies.

5. Assist the line organizations to determine the degree of VE manpower they require.

6. Coordinate the VE efforts of responsible activities.

7. Prepare reports on VE studies.

8. Prepare reports crediting the line organization with the cost saving or value increase.

9. Be responsible for follow-up on all Value Engineering Change Proposals (VECPs) from the point of initiation to the point of implementation.

10. Maintain a status report on all VECPs from their inception until a final cost effectiveness has been established.

11. Develop cost data and to support the line organization value engineers and disseminate the cost data and information on technological advances in a manner which will benefit POD personnel in all activities.

12. Provide guidance to Contracting Officers concerning incorporation of a VE incentive clause in contracts.

13. Assist in evaluating contractor VECPs.

14. Act as technical consultant to other divisions of the Bureau and other elements of the POD on VE matters.
    Note: As the VE Program becomes operational, VE technical personnel will be integrated into other Bureaus.

15. Assist in the planning and development of operating policies, technical criteria and standards for the guidance of the Bureau technical personnel in accomplishing program objectives.

16. Prepare necessary documentation form and procedure for maintaining and reporting VE performance.

Step 3

Establishment of Work Projects

Work projects fall into the major categories of Contractor and in-house work projects.

Contractor VE projects involve the use of VE contract clauses. Until such clauses are established and a change control system is established and approved for POD use, the VE staff will confine work projects to in-house projects.

In-House work projects can vary from one-man efforts to "task forces." In all cases the VE work projects will be in support of the line organization and performed with their approval. To establish a valid audit trail, a POD Form 4126, Figure 3, is required to initiate a VE study. The VE Staff will make a feasibility review of the proposed project to determine the level of effort required, the cost of the study, and the potential accomplishment.

Upon concurrences of the line organization a VE work project can then be undertaken to perform the VE study.

The results from the VE study will be documented and presented to the responsible line management by the VE study team.

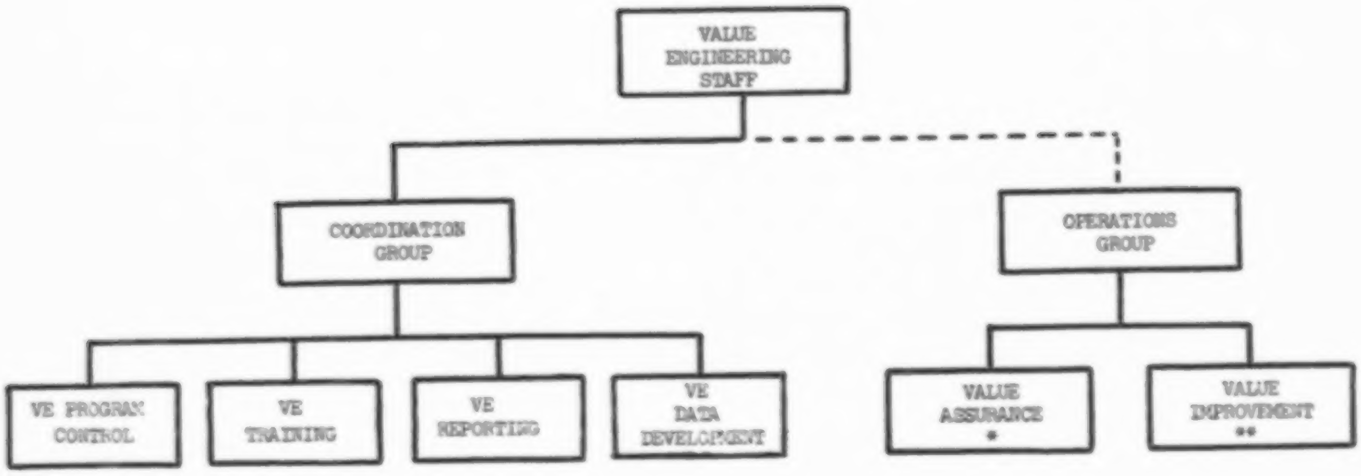
Step 4

Implementation of Value Engineering Proposals

The VE Staff is basically responsible for the data and documentation required by line management to support a VE proposal. The VE Staff responsibility does not end with line management approval of the VE proposal, but must apprise management of the current status until implementation occurs.

Implementation of VE proposals is a matter of line management decision in which VE has no voice beyond that of making recommendations and providing the evaluation data.

The VE Staff will follow-up the progress of VE changes until implemented to provide complete management evaluation of the VE activity.


VALUE ENGINEERING STAFF
COORDINATION GROUP
OPERATIONS GROUP
VE PROGRAM CONTROL
VE TRAINING
VE REPORTING
VE DATA DEVELOPMENT
VALUE ASSURANCE *
VALUE IMPROVEMENT **

* PERFORMED DURING DESIGN AND DEVELOPMENT STAGES

** PERFORMED DURING PROCUREMENT AND SERVICE STAGES

FIG. 1 - VALUE ENGINEERING STAFF FUNCTIONAL ORGANIZATION

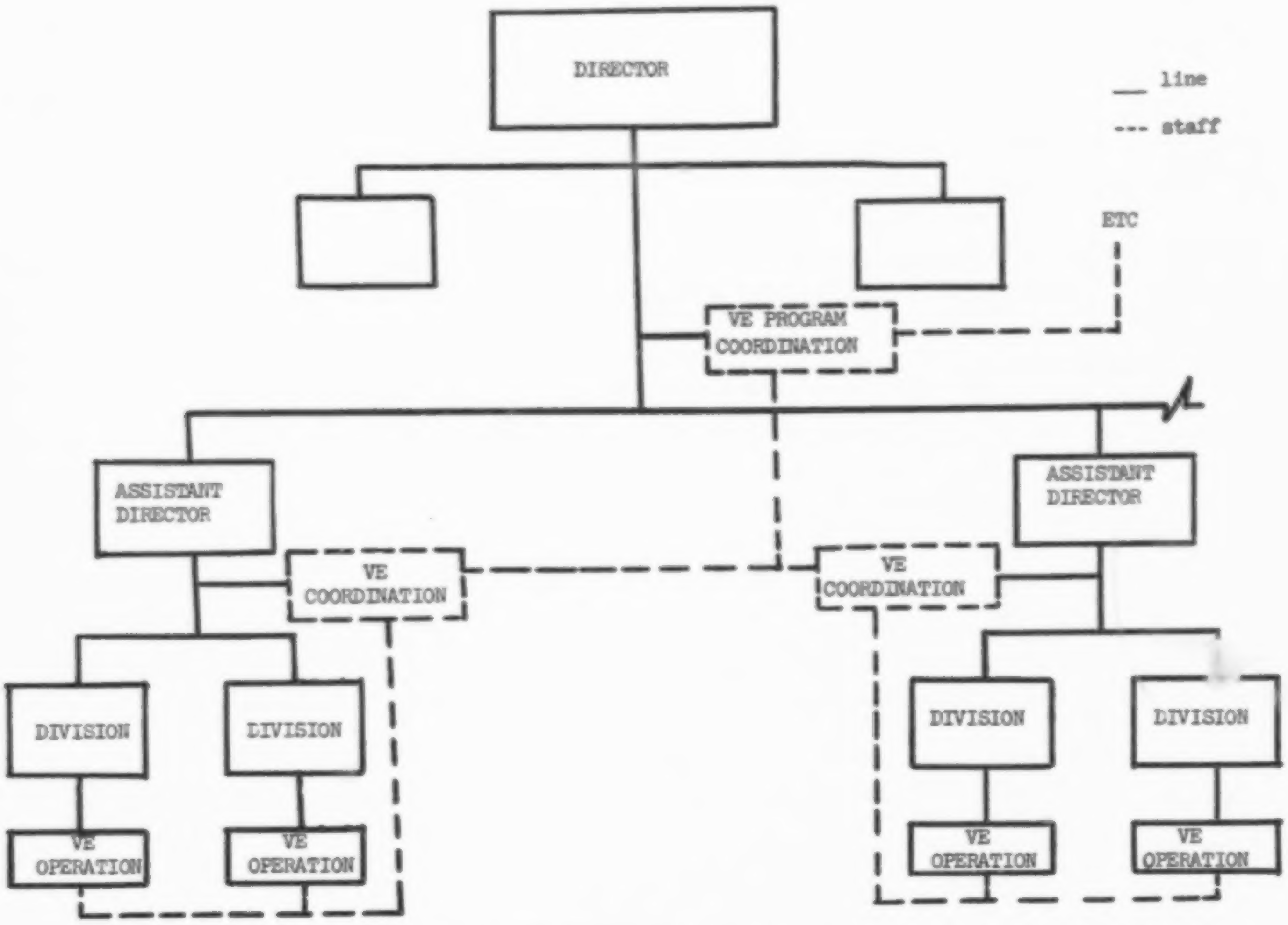
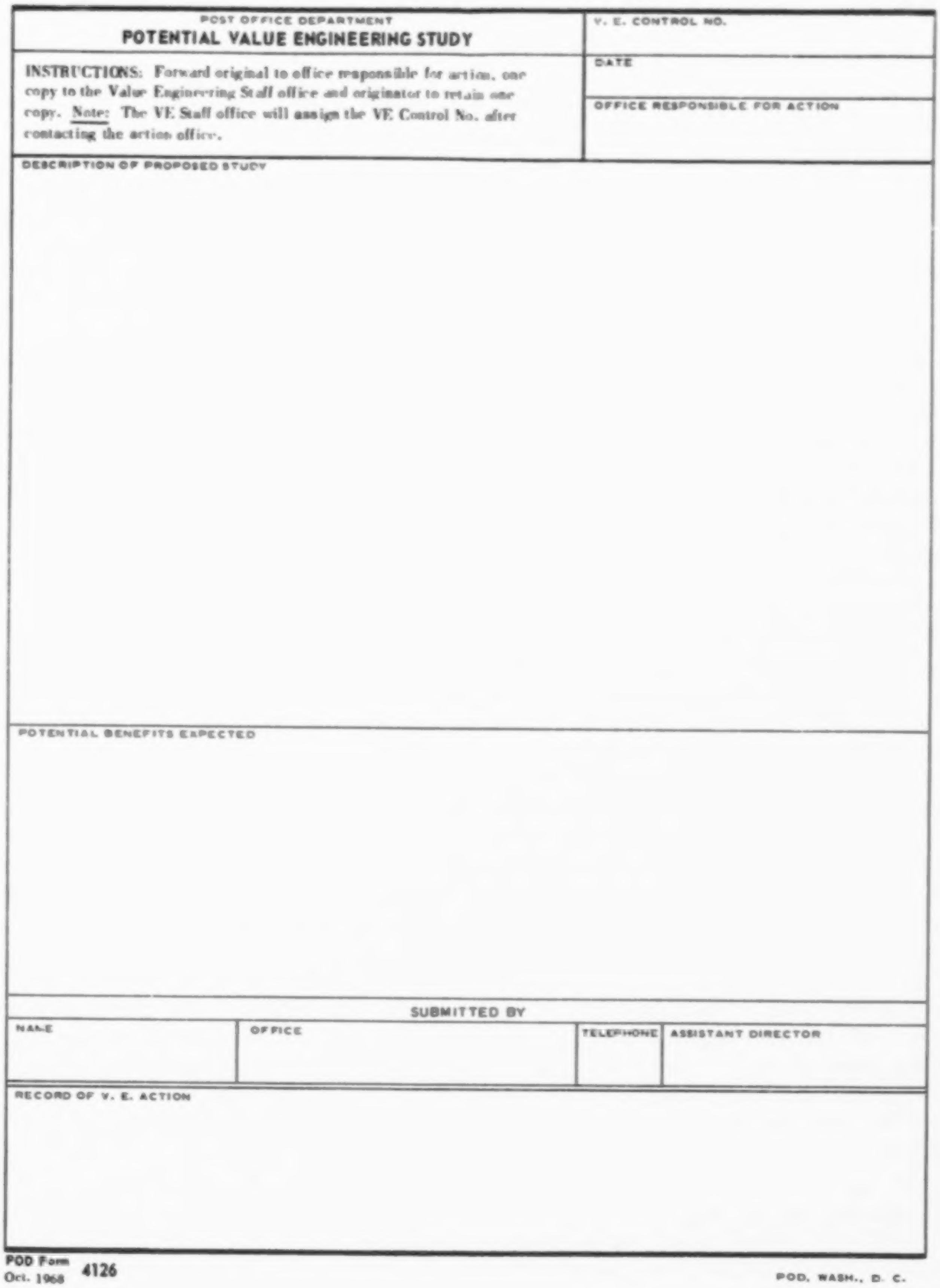

DIRECTOR
line
staff
ETC
VE PROGRAM COORDINATION
ASSISTANT DIRECTOR
ASSISTANT DIRECTOR
VE COORDINATION
VE COORDINATION
DIVISION
DIVISION
DIVISION
DIVISION
VE OPERATION
VE OPERATION
VE OPERATION
VE OPERATION

FIG. 2 - VALUE ENGINEERING FUNCTIONAL RELATION TO LINE ORGANIZATION



POST OFFICE DEPARTMENT

POTENTIAL VALUE ENGINEERING STUDY

V. E. CONTROL NO.

INSTRUCTIONS: Forward original to office responsible for action, one copy to the Value Engineering Staff office and originator to retain one copy. Note: The VE Staff office will assign the VE Control No. after contacting the action office.

DATE

OFFICE RESPONSIBLE FOR ACTION

DESCRIPTION OF PROPOSED STUDY

POTENTIAL BENEFITS EXPECTED

SUBMITTED BY

NAME	OFFICE	TELEPHONE	ASSISTANT DIRECTOR

RECORD OF V. E. ACTION

POD Form 4126
Oct. 1968

POD, WASH., D. C.

FIG. 3 POST OFFICE DEPARTMENT FORM NO. 4126

VALUE ENGINEERING IN AIR FORCE CIVIL ENGINEERING

Lieutenant Colonel Anthony D. Rynties, USAF

Continuing technological advances have generated a steadily increasing dependence upon support facilities throughout the U.S. Air Force. Early recognition of this trend (and the associated impact on operational capability) dictated that maximum cost-effectiveness be realized from available facility funding. Consequently, this realization further stimulated the cost-consciousness of Air Force Civil Engineering, as evidenced by carefully selected material standards, facility requirements guidance, definitive designs, technical reviews, and other similar economic innovations.

When Value Engineering (VE) was incorporated into procurement policy in 1962,* its Incentive Clause motivated the technical ingenuity of construction and industry in the Air Force's behalf. Since Air Force engineering and procurement are accomplished by separate staff offices, an important partnership in cost-effectiveness was thus formed.

Further solidification of this partnership was achieved in 1965 when an engineering publication** was issued relative to VE. In addition to providing improved insight into the VE Program, this directive formally established responsibilities and processing procedures for VE Change Proposals. Since cost-conscienceness was already woven into the entire fabric of Civil Engineering performance, this technical support of VE was implemented on an additional duty basis and full-time VE positions were not considered necessary.

Equally important, VE Programs were being aggressively pursued by both the Corps of Engineers and the Naval Facilities Engineering Command. Since both of these agencies are congressionally designated as the primary construction agents for the Air Force, their technical and contractual methodology has had considerable impact upon the Air Force economy.

The VE Incentive Clause is governed by the Armed Services Procurement Regulation (ASPR) and is equally applicable to each of the military services. Probable repetition of these details will be avoided by merely saying that such is normally included in contracts which exceed $100,000. The contractor then shares approximately 50% of any achieved savings which do not detract from necessary performance characteristics.

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*AFR 70-16, Value Engineering, 12 December 1962.

**AFP 88-009-2, Instructions on Value Engineering in the Air Force Military and Family Housing Construction Programs, 13 September 1965.

This cooperative program has continued dynamically to expose new economic challenges. In FY 1968 the documented VE savings exceeded $6,000,000, which include sizable contributions from both the Corps of Engineers and the Naval Facilities Engineering Command. Simultaneously, the engineering staff has pursued associated cost-effectiveness achievements, such as a comprehensive design manual, project development booklets, improved economic analysis, and an organized method of field-testing new engineering materials and techniques.*

Currently, Civil Engineering is actively participating in the Construction Advisory Board of the DOD Value Engineering Council. Further applications of the VE philosophy are being identified and explored.

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*AFR88-2, Evaluation of New Materials and Techniques, 1 August 1968.

VALUE ENGINEERING IN THE PUBLIC BUILDINGS SERVICE

Forrest Andrews

History Public Buildings Service (PBS)* interest in Value Engineering (VE) began about four years ago when our Washington regional office formed a VE committee. This committee produced several VE recommendations --one of which is now apparently saving PBS approximately 17 percent of the material costs for all finished aluminum products used, such as window frames.

In April, 1966, our Washington regional office recommended that incentive clauses be considered for construction contracts, and that, to test the concept, such a clause be used in a project contract. The region forwarded a model incentive clause to indicate what they had in mind. Because of the apparent complex legal problems involved with the recommendation, no implementation actions were taken.

However, we continued to study the opportunities presented by VE. On March 3, 1967, the PBS Deputy Commissioner formed an Ad Hoc VE Committee made up of members designated by each of the offices in the Service. This committee recommended, substantially, the following:

1. That a VE program be established for all areas of PBS.

2. That a small staff of trained value engineers, with secretarial help, be established, and that it report directly to the Office of the Commissioner, PBS.

Implementation of these recommendations was actively underway in the summer of 1967, but an austerity program in new construction followed in which further implementation was deferred.

More recently, the application of VE techniques to the design of public buildings has been made part of our Management Improvement Program. A special study group has been formed and is currently considering the broad area of alternative construction contract procedures.

An orientation seminar for Research and Standards Division personnel was held in August, 1968. The newly formed Research Branch in our Research and Standards Division is developing expertise in the VE area. Three of our regional offices have recently indicated an interest in VE, especially as it relates to incentive clauses for construction contracts.

Position on Value Engineering PBS's position on VE is best stated by a brief summary of three ideas found in the testimony of the Deputy Commissioner, PBS, before the Senate Public Works Committee on August 2, 1968:

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* An Agency of the General Services Administration

1. The GSA recognizes its need for a VE program.

2. GSA definitely intends to obtain a VE program.

3. GSA maintains a cautious attitude toward incentive clauses in construction contracts, primarily because of the risk of being flooded with suggestions that are motivated by expectations of financial gain without equivalence in value.

Activities Our significant VE efforts, to date, consist of:

1. In March, 1968, GSA retained Louis C. Kingscott and Associates, Inc., to make a VE study of GSA Standards and Criteria, using an actual design as a basis for cost analysis. The Kingscott report was received in May, 1968, and identified nine changes which would permit substantial savings, plus eight additional ideas for VE analysis, and thirteen ideas for future long range consideration. It also recommended that GSA establish a formal VE program with a full-time VE staff.

2. The National Bureau of Standards is presently cooperating with PBS in a Building Systems Project, the potential objective being to purchase 1,000,000 square feet of office space as a pre-engineered package. The emphasis placed on performance criteria, alternative methods, comprehensive viewpoint, and methodology, encourages the parallel development of VE.

PBS has recently decentralized its building design review function. Plans and specifications, heretofore reviewed at the Central Office, are now largely reviewed at the ten regional offices. This has created a challenge and an opportunity for an overhaul of our guideline documents and technical criteria, and for evaluation of new techniques for achieving economies. With the appointment of a member of our Research Staff to pursue VE, we anticipate a stronger program.

AN ANALYTICAL SUMMATION

Henry A. Borger*

This is an overview of what construction agencies are doing with value engineering, with particular attention paid to similarities and differences in the various programs. It is more than a summary of the contents of the papers which were prepared before the conference; it also reflects my interpretation of what has been written (reading between the lines if you will) and informal discussions that I have had with the authors. Knowing this, you will be saved the frustration of trying to relate what I say directly with what you have read. I am taking this liberty for two reasons: (1) it makes the preparation of a summary somewhat easier; (2) it permits me to include some possibly controversial ideas in the hope of stimulating discussion among the panel members themselves and between the panel and you in the audience.

Another liberty that I am taking is to separate, for discussion purposes, the value engineering programs related to the design work of agencies from those programs that take effect after a construction contract has been let. Although these two categories of program apparently are not separated organizationally by the agencies practicing both types of value engineering, the fact is--as I hope to demonstrate later--that they are distinctly different.

Value Engineering in Design

The most basic fact is that only four of the seven agencies which submitted papers currently practice value engineering in design on anything like a continuing basis. The Air Force is one agency that does not. It prefers to utilize informal in-service procedures--while participating at the same time in the formal programs of both the Army and the Navy in their construction for the Air Force. The Air Force contends that its informal procedures permit economies without the handicap of formalized value engineering documentation. The Veterans Administration and the Public Buildings Service are the other two agencies that do not have value engineering-in-design programs. Both indicate keen interest in developing such programs, and both have experimented with the technique, but neither has actually put a program into effect.

But, so far as this conference is concerned, the fact that only four of the agencies actively use value engineering in design is not a drawback, because these four represent a broad spectrum of possible approaches to value engineering in design. The four agencies that have value engineering-in-design programs are the Army Corps of Engineers, the Naval Facilities Engineering Command, the Bureau of Reclamation, and the Post Office Department.

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*The preceding papers in Section III of this report were prepared and printed prior to the conference as background information. In lieu of their oral presentation to the participants, Mr. Borger gave the summation presented here.

Ten Key Factors in Value Engineering Programs

To provide a basis for comparing the programs of these agencies, it is necessary to identify the key common factors in value engineering programs. These factors are determined by the nature of value engineering itself.

Value engineering involves, basically, an in-depth study of a system, an item, or a technique for doing something to find the least costly solution that will satisfy the predetermined requirements for the system, item, or technique--in other words its performance, durability, reliability, etc. The two important points here are: (1) the "least costly" solution should result; (2) an "in-depth" study is involved. This means that, on the one hand, value engineering can save money, and hence should be encouraged; but, on the other hand, a value engineering study can cost a lot of money--it does not have to, but it can--and hence, it should not be undertaken frivolously. It follows, then, that a successful value engineering program must be so structured that it will promote the effective use of VE but minimize the chance of money being wasted. There appear to be 10 key factors that determine how this dual objective is to be realized:

1. How VE study proposals are generated
2. How proposals are screened and selected
3. Who actually performs selected studies
4. How studies are paid for
5. How those performing the studies are trained in VE methodology
6. How such training is paid for
7. How study costs are controlled
8. How results are implemented
9. How benefits are measured
10. How the overall VE program is stimulated

Comparison of Value Engineering-in-Design Programs

Before examining these factors as they apply to the four agencies having value engineering-in-design programs, it should be noted that the Army Corps of Engineers and the Naval Facilities Engineering Command have what can be characterized as extensive, formal VE organizations; the Bureau of Reclamation, at the other extreme, has no formal VE organization; and the Post Office Department has a very limited formal VE organization.

Now, with regard to the ten factors:

1. How VE study proposals are generated

This factor is particularly important; a good flow of suggested subjects for in-depth studies ensures that there are many possibilities to consider.

Corps: Varies from District to District, but generally proposals are generated by VE personnel (engineers assigned to VE work) in District offices as a result of review of project plans and specifications.

Navy: Sometimes by VE personnel in field offices as a result of review of project plans and specifications; sometimes by suggestions to the VE personnel from design engineers.

Reclamation: By management, or by suggestions to management from design engineers.

Post Office: By design engineers to the VE coordinator.

2. How proposals are screened and selected

Another critical factor: Are the subjects selected likely to give a good return?

Corps: Sometimes by VE personnel; sometimes by a standing VE project selection committee; sometimes by an *ad hoc* VE committee; sometimes (presumably) by the chief official in the District.

Navy: Sometimes by VE personnel; sometimes by the chief official in the field office.

Reclamation: By engineering management.

Post Office: By engineering management.

3. Who actually performs a study

This refers to in-depth studies.

Corps: Sometimes teams of Corps engineering personnel; sometimes individual Corps engineers.

Navy: Sometimes Navy design engineers; sometimes Navy VE personnel.

Reclamation: Special design engineering teams.

Post Office: Sometimes Post Office design engineers; sometimes private engineering firms (under contract).

4. How studies are paid for

Corps: Presumably by engineering design funds.

Navy: Presumably by VE funds when performed by VE personnel, and by engineering design funds when performed by engineering design personnel.

Reclamation: Presumably by engineering funds.

Post Office: By VE funds.

5. How those performing the studies are trained in VE methodology

Corps: Originally it was by means of a formal training program, carried out on a crash basis by a consulting engineering firm; later through workshops, presumably conducted by Corps VE personnel and by use of printed instructional material.

Navy: VE personnel are presumably trained by means of headquarters-directed workshops and courses; engineering personnel are presumably trained by VE personnel and through printed instructional material.

Reclamation: Originally through formal courses conducted by a management consulting firm.

Post Office: Post Office personnel have apparently not received VE training under Post Office auspices (some undoubtedly received training elsewhere); private engineering firm personnel doing VE studies for the Post Office presumably have received VE training in a variety of ways.

6. How such training is paid for

This was not specifically indicated in the papers submitted.

Corps: Presumably by VE funds.

Navy: Presumably by VE funds.

Reclamation: Resumably by engineering funds.

Post Office: Not applicable.

7. How study costs are controlled

Information on this factor was not provided in any of the prepared papers; presumably for most studies, all agencies establish monetary or time budget and a progress schedule at the time a study is undertaken, and costs are controlled through these mechanisms.

8. How results are implemented

Without addressing the question directly, all the papers imply that responsibility for implementation of VE study recommendations rests with the ranking design engineer affected; it can be inferred, however, that VE personnel, when involved, try to encourage implementation--in some cases possibly by going over the head of a design engineer.

9. How benefits are measured

The Corps and the Navy measure benefits against pre-established annual goals on the basis of the rules established by the Department of Defense Cost Reduction Program. Reclamation and the Post Office presumably determine benefits on an ad hoc basis and presumably do not establish goals.

None of the papers indicates whether or not the cost of the VE study which resulted in the savings, or the prorated cost of the overall VE program, is subtracted from benefits reported.

10. How the overall VE program is stimulated

In the Corps, the Navy, and the Post Office, responsibility for stimulating use of VE rests with the VE staff.

In Reclamation, whatever stimulation VE gets, comes from engineering management.

To summarize, it appears that, in Reclamation, VE-in-design is completely in the design engineering baliwick; in the Navy, it is to a considerable degree in the hands of VE personnel; and, in the Army and Post Office, it is more of a joint venture between the VE staff and the engineering section, with the VE staff playing a slightly more prominent role in the Army program.

One important matter, not clearly brought out in the papers, should be mentioned: The agencies do not have the same concept of what constitutes a VE study. The Navy and Post Office, for example, tend to take the liberal view that any investigation which aims at reducing cost without sacrificing requirements is a VE study. The Army and Reclamation, on the other hand, tend to apply the term "VE study" only to relatively elaborate studies in which formal VE methodology is employed. This difference in concept makes it difficult to make a direct comparison of agency programs.

Value Engineering in Construction

Value engineering in construction--i.e., VE by a contractor after a construction contract has been let--is a mechanism to encourage cost savings innovation on the part of the contractor by permitting him to share in savings resulting from changes he suggests in methods or materials which do not detract from the real value of the item being supplied.

Four agencies have clauses in their construction contracts providing for VE by the contractor: The three military services and the Bureau of Reclamation. All use essentially the same clause and implement the program in essentially the same way. From what is presented in the papers, it appears that the savings from this program have not been substantial, amounting in the Navy to only approximately 1 percent of the savings realized from the VE-in-design program, and in the Army to only 4 percent.

Of the three agencies that do not have value engineering-in-construction programs: one, the Post Office, indicates that it would like to initiate such a program; the other two indicate little interest, the Veterans Administration because it sees greater benefit in working on the value engineering-in-design program, and the Public Buildings Service because it is concerned about being swamped with VE proposals from contractors. Actually, it is doubtful that contractors really practice VE; more likely, they accidentally find good ideas. Use of the clause probably came from Defense Hardware contracts when the contractor is also the designer and in a position to do true VE.

V

ANALYSIS OF SPECIFIC PROBLEM AREAS IN VALUE ENGINEERING

This section contains papers formally presented at the conference by members of the Value Engineering Panel on problem areas that had been identified prior to the conference. The presentations served as a point of departure for a general discussion of the problem areas by the panel members, in which other participants in the conference were free to take part.

PRINCIPLES OF ORGANIZATIONAL ARRANGEMENTS FOR VALUE ENGINEERING

William S. Alldredge

The size and type of value engineering organization within an agency depend upon the size and type of the agency involved, as well as the VE potential that exists within that agency. The comments here are based on the assumption that the agency is large and that high VE potential exists; i.e., the agency is responsible for production or construction of sufficient volume to assure a high return for dollars spent in the VE effort.

Logically, a newly formed VE organization should have its beginning at the top. Before any meaningful direction can be given to the field, there must be a firm organizational foundation within the office of the head of the agency. One or more carefully chosen value engineers should be the nucleus of the VE organization. These persons should be educated or trained in at least one engineering discipline, should be well trained in the principles and application of value engineering, and should be thoroughly familiar with the agency's functions and methods of operation.

The head of the VE organization will, by necessity, deal with many elements of the agency; therefore, ideally, the VE office should be established at staff level. This will enable the VE office to deal directly with the various elements without having to cross organizational lines and will make evident the existence of strong top management support, without which the VE program will never fully succeed.

The next extremely important step is the establishment and publishing of the VE policies of the agency. Any directives issued will immediately establish the pattern of the organization and the direction in which it will begin to move. For this reason, the directives or regulations issued must be the result of the most careful planning and preparation.

Among many other important issues, establish policy must dictate the minimum organization to be established in field offices. Here the same ground rules apply as in the agency's headquarters. Assuming the VE potential exists within a field office, there should be at least one person selected to direct the local program. His qualifications should be similar to those of the head of the agency's program. Again, he should be located at staff level, and he must be fully supported by top management.

For necessary assistance, the field office value engineer will begin an intensive training program. He may find it advantageous to establish a VE advisory council, made up of key personnel. Certainly, the organization must display impressive strength--from the beginning--to assure full success of the program.

The importance of the establishment of a solid, meaningful VE organization cannot be overemphasized. Without such an organization, the program simply will not succeed.

COST REDUCTION AND VALUE ENGINEERING

Laurence Schuman

Value engineering in the DOD construction program is closely allied to the cost reduction program (CRP). As a result, certain misconceptions arise concerning these two management systems. They are not one and the same but are separate and distinct. Value engineering aims to improve the final construction product in all ways including cost savings, whereas the cost reduction program is a device set up to measure Government savings in all categories, including any cost savings developed by the value engineering program.

Value engineering has many interfaces with other management programs. There is the line command, of course. The largest interface is with the cost reduction program; others are design and specification, cost estimating, contracts, maintenance, audit, and the men from Missouri in construction. The cost reduction program, with the audit service, has the most effect on value engineering operations.

What is the difference between VE and CRP? First, VE is a system to develop the most effective way to achieve or perform a function, whereas CRP is a system for reporting benefits from individually identifiable cost-saving actions. Second, VE uses special techniques for development of proposed actions, while CRP uses special systems for recording and reporting of actions. Third, VE is staffed by engineers, architects, and other specialists trained in the construction field, while CRP is staffed by auditors, accountants, and other trained administrative specialists.

How do these programs interface? VE supplies CRP with a significant input of dollar savings (approximately from two-thirds to three-quarters of the CRP total), while CRP keeps the books on VE performance measured toward the dollar goals. VE suggests or recommends dollar goals, while CRP sets such goals to be saved by VE. CRP also sets up rigid rules for reporting and audit of VE actions. VE assists CRP with technical advice on audit problems that may arise. VE assists the CRP in preparing exhibits and other promotional material for CRP actions, and CRP makes awards for outstanding cost-saving performance.

Unfortunately, the rules of the overall CRP are set up for hardware and fit the construction field but poorly. Such rules work a hardship on both VE and CRP. VE personnel should develop an understanding of CRP as a key to that measure of success now enjoyed by VE. Thus, it is necessary to look into CRP's problems and the effect of VE on the work of CRP.

Under CRP, cost savings are reported in 20 different categories, one of which is value engineering. But not all savings resulting from the efforts of value engineering are credited to the value engineering category.

CRP rules are such that much of the work of value engineering personnel is credited to some other category. In addition, much value engineering effort is not reportable at all within the CRP rules, including VE actions which do not decrease costs although they improve project effectiveness. For instance, the final report for Fiscal Year 1968 for the Naval Facilities Engineering Command shows that only $10.5 million was creditable toward the VE goal out of a total of $26 million saved by VE actions. Other cost reduction areas benefited from this work by $3.3 million, while $5.4 was reported to the benefit of other DOD components.

The value engineer must be involved in many subjects. The rule book lists sixteen general areas for his activity, ranging from technical requirements, through the design cycle, and quality assurance, to the salvage of excess material and equipment. In addition, he must prepare reports, make cost estimates, and create good will throughout his organization to eliminate the automatic negative response of those who still believe that little good can result from VE.

VE reports must be complete and cover all points required by the CRP rules. In addition to the VE technique steps, the report must clearly indicate the condition existing prior to the application of VE, the VE study and recommendation, and the formal acceptance of the recommendation for implementation by the responsible design officer. The value engineer must follow through on all points and assist the CRP personnel in obtaining validation. Many actions, which have been accepted and implemented as good technical work, have been rejected by the cost reduction program and the audit program because of bookkeeping rules.

The relationship of the three programs--VE, CRP, and audit--appears to be as follows: VE needs CRP and audit for recording and validation of its performance; CRP needs VE for its large input of savings actions; while the audit service sits in the over-conservative judgment seat to say yea or nay to both.

THE POSITION OF VALUE ENGINEERING IN MANAGEMENT

Sidney J. Helene

Because the Veterans Administration's value engineering program has not yet been established as a continuing operation, it is possible to describe only how the program has been *designed* to function. The actual initiation and further development are now awaiting a management decision.

Our first experience with value engineering began with a training seminar arranged and conducted by our Research Staff with the aid and instruction of a fee consultant, in which it was demonstrated to a cadre of experienced architects and engineers that even a *partial* value engineering review of an ongoing $19 million hospital project selected for study could result in very significant cost savings, with only minor design changes required in the contract documents. Developing out of the demonstration were recommendations for a value engineering program to be conducted in the working drawing stage for selected VA projects. The program is visualized and was recommended by the Research Staff as follows:

> "Initially at least, the program will be administered by a single Veterans Administration employee value engineer who should be thoroughly experienced in building design and construction, preferably in the fields of operations of this agency, which are involved with hospitals and other related buildings. This Value Engineer will make initial reviews of ongoing projects to select projects for further study. He will also prepare for presentation the findings and recommendations evolving from the studies."

To assist him in technical interdisciplinary decisions, the Value Engineer could call upon a number of architects or engineering specialists as *ad hoc* value engineer teams, within the design units of the Office of Construction. Specialists in the various engineering fields, who have been designated to lend support to the program and who will make up the teams, have had initial training in value engineering. These men will be excused from their day-to-day duties for the time periods necessary to help identify areas for value engineering review and to aid in selecting cost conscious substitutions for systems or subsystems. They will also aid the Value Engineer in obtaining cost figures and in writing justifications for the changes recommended to be made in the design.

It is intended that the value engineering process eventually be applied to in-house as well as architect-engineer-designed projects, preferably the larger ones. Following the identification of promising areas for study, the discovery of available value engineering substitutions or other modifications, and the preparation of proposals to management for decisions, the more difficult aspects of the problem begin to unfold. These consist principally of persuading the project directors and designers to make the decision to implement the value engineering proposals, but always with the acquiescence of the value engineering office in an acceptance of an ultimate decision to implement or not to implement. There are many reasons why a negative decision on value engineering proposals may be justified, but time does not permit expanding on this subject.

It can be seen at this stage, however, why it is advisable to have the value engineering effort attached to the top management staff. Value engineering, to be effective, requires the stature and authority that top management can give the value engineer in his contacts with middle management decision makers, in design and construction. Even then, there may be many obstacles in the path of implementation, some of them purely human ones.

It appears essential that all value engineering proposals, justifications, acceptances, and rejections be made in a formal "completed staff action" manner and through channels involving top management. Value engineering efforts cost money, which could, it is hoped, be returned manyfold in savings, and the effort should not be wasted by arbitrary rejection or reluctance to act by lower management echelons. Incentives may well be advisable to spark enthusiasm for the value engineering effort, such as recognition of both value engineer and designer team effort for effective cost savings, that is, savings which result in equal functional quality or better value for the money expended.

Experience in the program as it develops will undoubtedly teach us how to improve our organization and our proposed method of operation.

CONTRACT INCENTIVE CLAUSES

Lieutenant Colonel Anthony D. Rynties, USAF

Contract incentive clauses are fundamental to the value engineering program, and introduction of this subject normally generates a healthy amount of discussion. To provide a basis for your further comments and questions, it is desirable to indicate certain basic rationales.

It must be acknowledged that the construction industry is highly competitive, and the continuing survival of individual contractors is dependent upon relatively narrow margins of profit. Consequently, there has been a historical reluctance on their part to recommend any significant reduction of contract scope--this being normally accompanied by a proportional reduction of anticipated profit.

Recognition of this non-motivation also assumes that the contractors are capable of making worthwhile recommendations on our completed designs. This appears to be a logical assumption, because their economic competitiveness necessitates the development of expertise in product technology and performance methodology.

When these initial capability and "non-motivation" hurdles are passed, it is merely necessary to select an appropriate incentive. Monetary reward is the obvious solution, and this is not the basis of our incentive clauses.

Without becoming overly involved in the phraseology or detailed content of these clauses, it is desirable to mention several brief but important considerations.

Value engineering by a contractor involves a certain amount of risk. It costs money to search for realistic savings which can be shared--and not all his proposals will be acceptable.

The sharing percentage must be equitable to both the contractor and the Government. A serious imbalance in favor of either party would reduce the attractiveness of the arrangement--and progressively reduce effectiveness.

The value engineering program has successfully recorded a constantly increasing amount of audited savings to the Government.

Value engineering proposals for changes provide a continuing feedback which assists in preventing our design procedures from becoming outdated or unduly restrictive.

In effect, a contractor's participation in value engineering is really an expansion of his product line. He is selling an additional service--his technical knowledge.

VALUE ENGINEERING--PROJECT SELECTION AND INITIATION

Forrest Andrews

No value engineering project is likely to succeed without both line and management support. The best time to obtain this support is at the outset--at the initiation of the VE project. Support at the outset identifies management with the project. In addition to helping to sell the eventual product, such early identification enables the value engineering investigator to obtain management backup and assistance during all phases of the project. Thus, methods of project selection and initiation are of great importance to the entire VE program.

Project selection refers to the technical level procedures used to choose, from among the various possibilities, those projects which combine the greatest merit with the highest probability of success. Project initiation refers to the procedures whereby management accepts specific projects for formal study.

The formal techniques for project selection are well established in some Federal construction agencies; for example, the current Department of Defense VE Handbook lists criteria for identifying potential VE projects and gives methods for ranking them for selection.

The scope of selection possibilities is extensive. Briefly, good prospects usually involve:

Large dollar expenditure or possible savings

Management interest

Advantages and benefits outside of cost

Some additional characteristics of good prospects are:

Old or obsolete technology

Operating deficiencies

Complex product, system, etc.

Lack of large foreseeable deterrents

Time compression in the development time

Having developed a list of potential projects with the help of the general principles listed above, final selection may be made. The following considerations are valuable aids to this selection process:

Relative cost ranking

Cost reduction potential ranking (where index of cost reduction potential equals estimated savings multiplied by probability of implementation and divided by estimated study cost)

Value standards, both historical and theoretical

Consideration of resources in knowledge and talent available

It would appear that the general approach to identifying WHAT to analyze--in other words, the selection process--is pretty well in hand. However, there is a problem in maintaining full objectivity in the selection process, especially where there are differences of "validatability" between projects of otherwise generally equal merit. R.L. Crouse of Honeywell's Aero Division points out that value engineers tend to become emotional on the subject of validating savings. Validation in terms of dollars saved is their lifeblood. Consequently, to propose that value engineering projects be undertaken at the conceptual stage, where such validation is sometimes impossible, tends to bring a negative reaction from them, even though they realize that the earlier the analysis the greater the probable benefit.

Construction time, an area offering important possibilities for project selection, is increasingly difficult to validate. Private builders are building structures in less than 20 months from concept to occupancy. The effect of such schedules on VE in the construction area is very considerable, since VE projects must necessarily be completed in a very short time, and validation thus becomes more difficult.

The process of initiating selected projects is also important. The manager needs much of the same type of information, to a lesser degree, at project initiation as he does before implementing a finished VE proposal, and the initiating action must speak to these needs. Some of these are:

A clear description of the problem and the proposed project.

The reasons for confidence that the project is appropriate, including rough estimates of manpower and other resources necessary to undertake the study, and of potential savings.

Despite the rudimentary development of the project at this time, as many elements as possible should be covered in these estimates.

Assurance that the project fits into the manager's long-range plans.

Several other aspects of project initiation deserve more attention. A worthy problem is how to make sure that proper credit is given for project initiation, and how to make sure that no one is embarrassed by this action. Lawrence Miles, in his lecture THE TROWEL AND THE SWORD at the 1967 SAVE Convention, showed very graphically through several examples just how destructive to VE efforts high level professional embarrassment can be, the usual effect being that the offending value engineer either had his prerogatives reduced or was cashiered outright.

A professional's failure to recognize a problem in his area might be more embarrassing to him than most other types of failure. It would seem to reflect upon his basic capability and thus to damage his self-image. Thus, not only WHAT but HOW a project is initiated is very important.

Another aspect of the selection and initiation process--one that must precede the other two--is that of identifying potential projects. It is perhaps trite to say that it is important to formalize this process, but it is frequently overlooked. For example, the Post Office Department has developed a form entitled "Potential Value Engineering Study." This form serves the primary purpose of recording the inception of VE studies so that the start of the process may be positively identified when VE accomplishments are audited.

To sum up, the success of a VE program may depend upon the success of the procedures used for selection and initiation of VE projects; not only are formal procedures and guidelines important, but in order to operate effectively, a value engineer cannot afford to neglect the human aspects, and must operate with consummate tact.

CONFIGURATION MANAGEMENT AND THE FUTURE OF VALUE ENGINEERING

Riley A. Murray

Value engineering is new to many here and configuration management is even newer, but I think you will hear a lot more of both in the future.

By now you have some idea of what value engineering is all about, but you may not be familiar with configuration management.

In the DOD definition, configuration management is a discipline applying technical and administrative direction and surveillance to: (1) identify and document the function and physical characteristics of a configuration item; (2) control changes to those characteristics; and (3) record and report change processing and implementation. Those three elements have been entitled:

1. Configuration Identification
2. Configuration Control
3. Configuration Accounting

Finding a new way or a better means of doing something is the easiest part of value engineering. The most difficult tasks in VE are:

1. Identifying the needed requirements
2. Getting the changes implemented
3. Validating the results

It doesn't take a genius to see that, if configuration management has identified the item completely and follows up with an accounting of the implemented change, two of the big VE problems, identifying needed requirements and validating the implemented changes, would be greatly simplified.

The big VE problem would then be to get the changes implemented, and even here the configuration management control identifies those who control the changes.

One reason that VE has had difficulty selling new ideas is that the people to whom we are selling feel they have enough work already just making the "necessary" changes--"necessary" in this case meaning it won't work the way it is.

Some think that VE has been creating problems by trying to sell the better way for less money. The more informed person realizes that the "money well" is running dry and value engineering is one way to get what is needed and still stay within the budget. Configuration management is not only going to control an item configuration, but it is also going to make management aware of the item life cycle cost.

It seems likely the concept of configuration management is developing in great part as a result of the feedback from VE proposals.

Configuration management will not be panacea for all VE problems, because there will be always "people problems." But, if a feedback loop is developed between value engineers working at the design level and configuration management operating at the management level, at least a communication link will be established that may bridge the present communication gap.

Configuration management has been referred to as management relative to a set of base lines. Many will refer to it as just "good management" practice in much the same way that VE is referred to as just "good engineering" practice. The key word that should be emphasized is "practice." You cannot just preach good engineering and good management--it has to be practiced.

Anyone who has done VE realizes how hard it is to establish the base line for new idea developments. If the feedback from the configuration mangement base lines can be used for the VE base lines, many unnecessary steps will be saved in traveling down blind alleys.

My reason for bringing configuration management into a VE conference is that I view VE as a dynamic management discipline that should expand and change to meet future requirements. Configuration management is developing to meet a specific management need which VE should explore for mutual benefits.

EMPHASIS--TECHNIQUES OR PROCEDURES?

Harold G. Arthur

We have pretty well agreed that value engineering is a systematic and orderly method to analyze the function of a structure or a system for the specific purpose of finding an equal or a better way to satisfy that function at a lesser cost. To be successful, it would seem that value engineering must be a philosophy, an attitude, that each engineer should have when examining the project as a whole.

There is no reason why there should be difficulty in instilling such a concept in a design organization, especially if it is close-knit or small. No doubt this becomes progressively more difficult with more widespread decentralization. Where all design work is contracted out, the indoctrination and particularly the implementation will be more difficult; it may require an in-house staff of experts to make the analysis or some unusual contractual arrangement with a third party.

Under any arrangement, each engineer contributes his specific design to a compilation of drawings which constitutes a plan for construction of a structure. Thus he is not in a position to question the whole structure or its function. He works upon his particular portion and he can only apply the philosophy of value engineering and be innovative in his work. On the other hand, the Chief Designing Engineer and his staff, in applying the philosphy of value engineering, have the opportunity to look at the structure as a whole to determine if there is a better way to accomplish the same purpose or some internal system at a lesser cost.

Should the Chief Designing Engineer conclude that perhaps a different type of structure could be evolved at that point, it would be necessary to call in many engineers of different disciplines to study the full problem or a component of the structure. For example, he might call in the Chief of the Mechanical Division and ask him to take a second look at the water supply and sewerage system, or the heating and air-conditioning system. He might appoint a task force from among the many disciplines at hand, or from other sources, who would take a fresh look at the objectives and consider whether or not the application of value engineering would be fruitful.

At this point, we have left the techniques and started to consider the procedures for accomplishing this candid appraisal. If the whole organization has a philosophy of value engineering, the organizational structure or the procedures for carrying out the re-evaluation or reassessment should be of minor consequence. Therefore, within the design organization it would appear that the organizational arrangements, as to who-does-what-and-how, is of lesser importance. In addition, it would seem that the disposition of any cost savings from the application of this technique should be of minor consideration. To say this another way: Just how the cost savings are to be reported, and whether these are or are not to be audited, is purely an incidental matter.

In summary, the acceptance of the philosophy of value engineering throughout the organization is of prime importance, whereas organizational arrangements to carry out the techniques are secondary.

INNOVATIONS AND MANAGEMENT SUPPORT

George B. Begg

I have been kindly permitted to step aside from my moderator's role to raise a few questions concerning value engineering innovations.

Value engineering has its share of problems in obtaining consistent management support. Many factors contribute to this inconsistent pattern, but it is less traumatic to our confidence levels and long-term plans if we remember that some of the tribulations of value engineering are directly tied into the larger framework of innovation implementation and management support.

Federal management is always torn between the desire to respond intelligently to its updating and upgrading needs and the need for caution in jeopardizing the fundamental nature of its ingrained procedures Much depends on how completely a given operation is associated with the implementation of innovations. Even the most conservative and tradition-bound organizations experience a fair amount of change due to revisions to enabling legislation, availability of funds, new personnel, etc. Those of you who have left a construction agency and returned a few years later for another tour of duty have a good perspective on the inevitability of this type of change.

The mention of conservative and tradition-bound offices is deliberately made in this context. Regardless of how enlightened and progressive the management climate, there is a logical and justifiable conservatism underlying many of our architectural and engineering practices. It is produced by many factors, including the requirements to justify our actions to regulatory agencies, the state-of-the-art in the private sector, the need to meet multiple and interlocking construction schedules for many projects, the well-established overall reliability of highly placed, conservatively oriented engineers and architects, etc.

Consequently, there is usually significant resistance at some technical levels, or higher, to the innovation proposals from the Director of Research, or Chief of Value Engineering, or the ordinary individuals who use the employee suggestion forms. And from painful experience--both real and imaginary--mangement has learned to listen to the technical arguments against innovation. Although few offices keep batting averages, the overall innovation implementation results appear to be some successes, and many compromises and rejections.

But some researchers and value engineers are more successful than others in the number of successful innovations that they are able to see through to implementation. I propose that the conference could profitably spend a few moments deliberating on the principles and techniques that consistently lead to the acceptance of new ideas by appropriate management levels, The concern underlying this proposal is that value engineers should be pursuing effective processing techniques when promoting justified innovations, rather than too easily excusing their implementation records by hiding behind claims of red tape, indifference, insufficient and myopic reviews, etc.

Now you all have your own checklist of what does and what does not work in your agency in this sporadic innovation area. It would be quite helpful if we could pool your information and see if there is a processing common denominator that we should all practice regardless of what type of innovation we are recommending. With this in mind I ask you:

1. Do we depend too much on rhetoric and speculation in recommending value engineering innovations? Rephrased, are we content to state the facts, logic, pros and cons, and concluding recommendations, or do we feel compelled to add glowing anticipated benefits, including somewhat inflated claims?

2. Do we know the sources of potential opposition and consistently try to deal with the best statement of their opposition?

3. Are we as frank and willing to talk and learn from our implemented innovation mistakes as we are when we have a shining success?

4. Do we provide for all the management concerns, including coordination, necessary compromises, etc., when submitting our value engineering innovations, or do we leave the manager with many unresolved problems?

5. Do we step back and critically look at the persuasiveness of our value engineering recommendations, or do we put them out on a take-it-or-leave-it basis?

6. What are the limitations in current innovation proposal techniques? How frequently should we take a critical look at how we process proposed innovations through the office?

Most of you have struggled with these problems from a technical or management viewpoint. During the discussions that follows please let us have your thoughts on how we can better obtain management support for value engineering innovations.

APPENDIX A

AGENDA

1.	Welcome	H. A. Borger
2.	Keynote	G. B. Begg
3.	Value Engineering in Federal Construction Agencies (An analytical summation of value engineering policies and practices)	H. A. Borger
4.	Discussion of Papers (Discussion of papers prepared prior to the conference as background information)	G. B. Begg and Panel
5.	Coffee	
6.	Analysis of Specific Problem Areas in Value Engineering	
	Principles of Organizational Arrangements for Value Engineering	W. S. Alldredge
	Cost Reduction and Value Engineering	L. Schuman
	The Position of Value Engineering in Management	S. J. Helene
	Contract Incentive Clauses	A. D. Rynties
	Value Engineering--Project Selection and Initiation	F. Andrews
	Configuration Management and the Future of Value Engineering	R. A. Murray
	Emphasis--Techniques or Procedures?	H. G. Arthur
	Innovations and Management Support	G. B. Begg
7.	Lunch	

8.	Discussion of Problem Areas (Panel discussion plus questions and comments from the floor)	G. B. Begg and Panel
9.	Analysis of the Future of Value Engineering	G. B. Begg and Panel
10.	Discussion of the Future of Value Engineering (Questions and comments from the floor)	G. B. Begg and Panel
11.	Conclusions	G. B. Begg
12.	Adjournment	

APPENDIX B

REFERENCE MATERIAL

Bibliographical Material

1. DoD Handbook 5010. 8-H, September 12, 1968, for sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. Price $1.00
2. Techniques of Value Analysis and Engineering; Lawrence D. Miles; McGraw-Hill Book Company, Inc.
3. Value Engineering in Manufacturing; American Society of Tool and Manufacturing Engineers; Prentice-Hall, Inc.
4. Value Engineering Bibliography; Society of American Value Engineers, 1741 Roswell Street, Smyrna, Georgia 30080

Training Courses

"Management of Value Engineering" courses are offered to qualified DoD personnel by

1. Army Management Engineering Training Agency, Rock Island Arsenal, Illinois
2. Air Force Institute of Technology, Wright Patterson AFB, Ohio
3. Nave Pave teams

NOTE: VE material specifically oriented to construction is limited. The reference material is mostly hardware oriented, although the basic principles are applicable.

THE NATIONAL ACADEMY OF SCIENCES is a private, honorary organization of more than 700 scientists and engineers elected on the basis of outstanding contributions to knowledge. Established by a Congressional Act of Incorporation signed by Abraham Lincoln on 3 March 1863, and supported by private and public funds, the Academy works to further science and its use for the general welfare by bringing together the most qualified individuals to deal with scientific and technological problems of broad significance.

Under the terms of its Congressional charter, the Academy is also called upon to act as an official—yet independent—adviser to the Federal Government in any matter of science and technology. This provision accounts for the close ties that have always existed between the Academy and the Government, although the Academy is not a governmental agency and its activities are not limited to those on behalf of the Government.

THE NATIONAL ACADEMY OF ENGINEERING was established on 5 December 1964. On that date the Council of the National Academy of Sciences, under the authority of its Act of Incorporation, adopted Articles of Organization bringing the National Academy of Engineering into being, independent and autonomous in its organization and the election of its members, and closely coordinated with the National Academy of Sciences in its advisory activities. The two Academies join in the furtherance of science and engineering and share the responsibility of advising the Federal Government, upon request, on any subject of science or technology.

THE NATIONAL RESEARCH COUNCIL was organized as an agency of the National Academy of Sciences in 1916, at the request of President Wilson, to enable the broad community of U. S. scientists and engineers to associate their efforts with the limited membership of the Academy in service to science and the nation. Its members, who receive their appointments from the President of the National Academy of Sciences, are drawn from academic, industrial and government organizations throughout the country. The National Research Council serves both Academies in the discharge of their responsibilities.

Supported by private and public contributions, grants, and contracts, and voluntary contributions of time and effort by several thousand of the nation's leading scientists and engineers, the Academies and their Research Council thus work to serve the national interest, to foster the sound development of science and engineering, and to promote their effective application for the benefit of society.

THE DIVISION OF ENGINEERING is one of the eight major Divisions into which the National Research Council is organized for the conduct of its work. Its membership includes representatives of the nation's leading technical societies as well as a number of members-at-large. Its Chairman is appointed by the Council of the Academy of Sciences upon nomination by the Council of the Academy of Engineering.

THE BUILDING RESEARCH ADVISORY BOARD, a unit of the Division of Engineering organized in 1949, undertakes activities to advance building science and technology when such activities are approved or assigned as appropriate functions of the National Research Council. It provides for dissemination of information resulting from those activities whenever doing so is deemed to be in the national interest.